TILTING IN THE MID-15TH. CENTURY.

Armour and Blade

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TO MY WIFE, KATHLEEN

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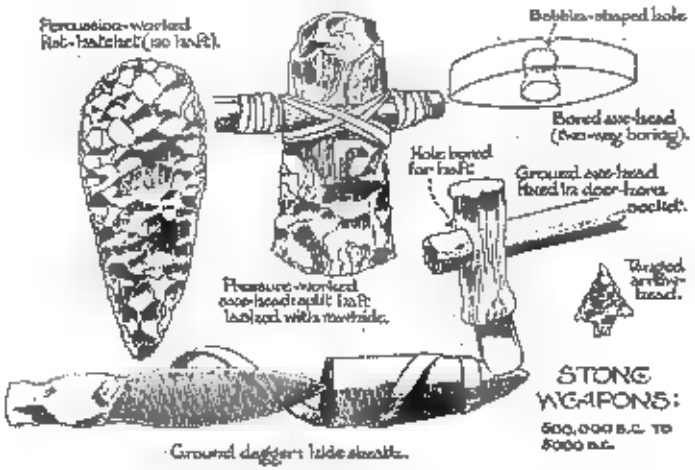
Soon the dusky villagers saw that it was hopeless. They had brave men, strong men, enough; some of them had even guarded their chests with several thicknesses of hide, and covered their heads with tough hide caps, but all to no purpose. Nothing could stand against the invaders with their bronze-scaled coats, their quilted helmets, and their stout shields of hide-covered wood with copper binding.

Their weapons, too – copper was scarce among the primitive villagers, fifteen hundred years before the birth of Christ, and most of the menfolk still used arms and tools of stone. Here and there were a few copper-headed spears, but every man of the attacking force was better armed than the best-armed defender. No Ethiopian warrior could hope to pit his antiquated war gear against the organisation of the empire-building Egyptians.

Though outclassed, the villagers' stone weapons were yet of fine finish and workmanship, far different from the clumsy fist-hatchets of their distant forbears. Hundreds of thousands of years had rolled between the first crudely chipped implement and the ground and polished stone arms of the village warriors. They bore well-hafted axes, keen flint daggers in leather sheaths, and spears and arrows tipped with skilfully-worked stone heads.

In this way the link with the remote past still held, and the



warriors' primitive leather defences recalled the perils of the earliest men a million years before. These had crept furtively to seek food in the haunts of the savage mammals that had succeeded those stupendous lizards-in-armour whose bones still survive to witness their gigantic size. Dinosaur, sabre-tooth, and ape-like [redacted] had passed away, though crocodile and turtle remained as living specimens of natural defence. In that changing world, the simple villagers were now confronted by the superior power of early civilisation.

Already the Egyptian archers and spearmen were closing in on the last pockets of resistance. Here the dreary line of prisoners was drawn up, their hands shackled before them [redacted] above their heads. The guards gathered around them. Each disciplined soldier was equipped like his comrades – the same type of head and body armour for the spearman, the round-topped, three-foot shield with its countersunk boss, and the bronze-headed spear. The archers' defences were made up of many layers of plaited flax, cemented and hardened with glue.

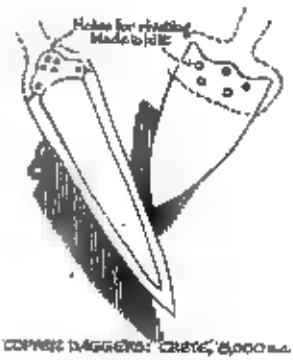
A number of officers and rankers carried swords of peculiar

form, like elongated daggers of bronze, without guards. They were about three feet long, with double-edged blades tapering to a sharp point.

Before the age of metal, the dagger had been the longest blade that could be made when the material was stone. As the practice of casting in metal developed in the eastern Mediterranean, about 3000 B.C., the early copper swords were cast in the shape of large daggers. These had short, broad blades, and they were fastened to their hilts by rivets at the base (a sword is always described ■ if it is held in the hand, with the point upwards).

Copper and bronze swords could only be used for thrusting – they would have broken with a heavy edge blow against armour, and in the early riveted swords the hilt would soon have separated from the blade. An improved type of sword was prolonged at its base into ■ *tang* for the attachment of

EGYPTIAN SOLDIERS OF 1500 B.C.



COPPER DAGGERS: CRETE, 2,000 B.C.

the grip. A raised central rib, running the length of the blade on each side, gave added strength, and in this way the true sword came into being. Its value was increased by the Egyptian hardening process for copper and bronze. This was simply a prolonged hammering of the edges, which compressed the porous metal into a hard, close condition with immensely tough wearing qualities.

It was fitting that among the Egyptians, who had the first standing armies of disciplined troops, the soldier should rank as [illegible] of the three classes of landowners, with kings and priests. Broadly divided into mounted troops and infantry, the army's chief strength lay in its archers, many of whom fought from chariots. Each chariot carried two men, a driver and a fighter.

Numerous Egyptian wall-pictures show chariot troops – their kings and nobles were always thus mounted – but there are few examples of horsemen. This does not necessarily [illegible] that the Egyptians were ignorant of the value of cavalry, for their horses were famous in the East. Egyptian commanders must certainly have seen the advantage of placing the fighting man upon his motive power, instead of behind it. However, as a good deal of their warfare was waged against relatively uncivilised people, the Egyptians probably considered that the chariot-array in full career was more intimidating than a body of cavalry.

It was not uncommon for a hero to dismount from his chariot to meet an opposing champion in single combat, a practice that was carried on in succeeding ages. Orderlies would take charge of the chariot thus vacated, if the hero had driven out alone – officers prided themselves [illegible] their ability to manage their chariots themselves. In the ordinary way, each chariot was manned by troopers of equal rank, trained in co-operation.

Training in the Egyptian army [illegible] rigorous and thorough.

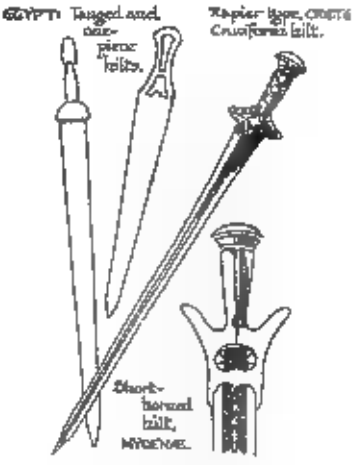
It began with comfortless barrack life at an early age, featuring physical training, athletics and mock combat. Each recruit was expected to provide his own arms and equipment, and the units were assembled according to the type of weapons employed. There were separate companies of bowmen, slingers, spearmen, swordsmen, clubmen, etc., commanded by under-officers. These arms were grouped in battalions, and the latter formed into regiments, each unit bearing its particular standard.

Heavy infantry, such as spearmen, were employed in close array resembling the *phalanx* of a later age, but they were trained to deploy in line or to break up in sections. Some of these troops were armed with pole-axes, battle-axes, or maces. The lighter units with missile weapons served in line or in open order, responding to trumpet-calls or the beating of the long drum.

Warriors' Progress

While Egyptian military power was spreading the empire of the Pharaohs, their traders were carrying on a flourishing commerce with the Ægean islands, notably Crete. The people of Crete had adopted and developed Egyptian culture before 2000 B.C., and numerous relics found on the island pay tribute to their skill and artistry. Among these relics are some very fine bronze swords of pleasing shape, with long tapering blades bearing most elegant and tasteful decoration.

There is little evidence of the regular use of body armour among the Cretans, but their murals show various helmets of leather, occasionally with crests. The most elaborate helmets



BRONZE SWORD FORMS, 2000 B.C.–1200 B.C.

of this era were seen in the discoveries at Mycenae, the mainland city that carried the Cretan culture to an even higher level. It was evidently a practice to guard the helmet with rows of boars' tusks, sewn in regular lines. A common body defence was a peculiar shield shaped like an 8, and covered with a design representing ox-hide.

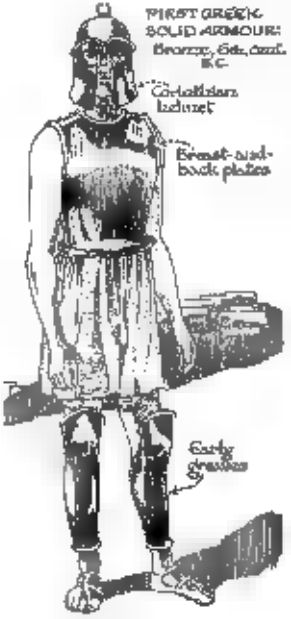
Such early examples as we have given were only preliminaries to the introduction of true armour. For the latter, we turn to the race of invading nomads who took over the Ægean

CRETAN AND MYCENAEAN HELMETS, 2,000 B.C.–1,000 B.C.

about 1200 B.C. These roving tribesmen settled on the mainland, and a nation grew up of mingled Ægeans and invaders, later known as Grakoi or Greeks.

At first the early Greeks lived in groups of villages, but from these arose the concept of the *city-state*, the fusion of each group into a separate political division. A city-state was a sovereign power, with its own king, gods, and troops, though Greece later resolved into four main regions governed as groups of city-states by the most powerful members. For instance, Athens governed the Attic peninsula, whose people were all styled Athenians, and Argos and Sparta ruled most of the Peloponesus.

The progress of metal-working among the people of the new nation produced the first solid body-armour. This consisted of heavy curved plates of bronze, to cover the body to



the waist. Straps at the shoulders and sides kept the pieces in position, and the lower edges were turned out to allow free movement of the hips.

Metal defences of this type were first used by the Greeks in the eighth century B.C., and with them were worn the leg guards known to us as greaves. The latter appear in Greek art at the end of the eighth century (though they were known at least two hundred years before). They became an important part of the defensive armour, so that a comparatively small shield could be used.

Greaves were formed of thin bronze, shaped to fit the lower leg, over which they clipped by their own elasticity. Some Greek vases of the sixth century B.C. show drawings of armour worn upon the thighs. Xenophon included such pieces in a list of cavalry equipment.

For some centuries after the formation of the city-states, armour was only worn by the richer Greeks, chiefly the nobles who became the ruling class under the kings. Many of the nobles gained their wealth by piratical excursions around the coast, and through this practice they were able to buy weapons and war gear. These nobles became the protectors of their communities, and inter-state battles were frequently decided by a series of single combats between champions. Ordinary troops were of little consequence.

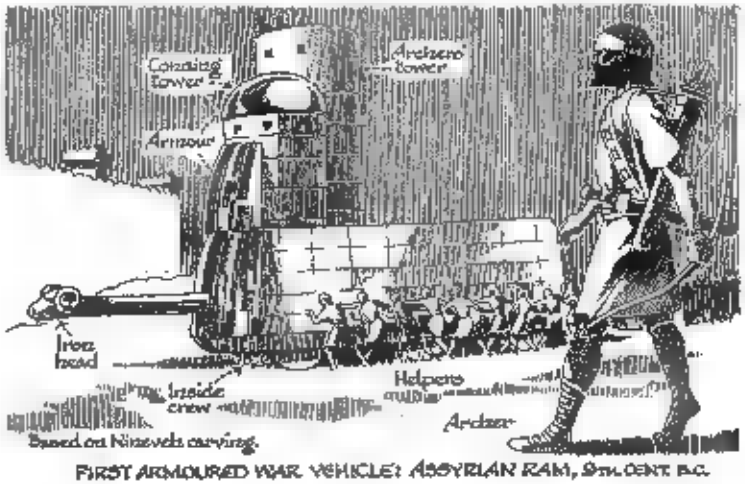
When the age of kings came to an end, about 650 B.C., the nobles assumed supreme power. Their knowledge of the sea made possible an expansion of trade, in place of the old-time piracy, and the increased revenue raised the general standard of living among the city-states.

One important result was the further development of armour manufacture, for arming bodies of foot-soldiers. In particular, an Athenian type of head defence known as the Attic helmet (see p. 19) was made in quantity, as being relatively cheap and easy to manufacture. We see by this the

growing importance of ▬ army, as opposed to the old idea of champions. There was little cavalry in the early days, for the terrain in Attica and the Peloponesus was unsuitable for horsed troops, but high-ranking army leaders took the field mounted. A horseman in armour was a formidable opponent for the ▬ on foot.

While Greek personal defences were thus building up, their traders were making efforts to establish market-colonies throughout Asia Minor. These probings were carried out by soldiers, but the eastward move met ■ severe check in 700 B.C. A Greek army was met and heavily defeated in Cilicia by the forces of Sennacherib, King of Assyria. At this date the ferocious Assyrians, whose country is now Syria, had achieved the conquest of the Middle East, by means of new weapons and an irresistible fury in attack.

An important feature of the Assyrians' success was their contact with the iron-working Hittites to the north. By this means the conquerors had equipped the first large armies to bear iron weapons, and they produced ■ formidable armoured



FIRST ARMOURED WAR VEHICLE: ASSYRIAN RAM, 9TH CENT. B.C.

fighting vehicle. This was the battering-ram, for use in the siege of walled towns. It is shown [redacted] a slab of alabaster carved with an Assyrian battle scene of the ninth century B.C., one of the earliest of their palace reliefs that have survived.

Owing to the sculptor's neglect of proportions, it is difficult to gauge the size of the machine. It was evidently built of timber, with six wheels, a metal-domed tower, and another tower from which archers could shoot covering arrows. At the front of the vehicle were curved metal plates, and a heavy slung beam with an iron ram's head protruded from a slot in the plates. The crew inside the body of the battering engine pushed to wheel it forward, and when it was near the wall they swung the heavy beam to attack the stones.

Arming the [redacted]

A prominent feature of Greek armour was the helmet, which is shown in two main forms. The earliest or Corinthian helmet was a complete bronze casing for the head and neck, with openings for the eyes and mouth. Broad metal wings enclosed the cheeks, and a vertical strip guarded the nose. This was [redacted] clumsy and awkward defence, for it rested loosely upon the head, and it could become an extinguisher if it were suddenly turned. In order to render it more comfortable for the wearer, a lining of felt or leather was arranged inside the helmet, and fastened to rows of holes around its edges. Sometimes a leather cap was worn [redacted] well.

When not in action, the Corinthian helmet was often pushed up on the forehead, with the lower part of the visor or face-

guard overhanging the brow. An example of this practice is seen in the traditional figure of Britannia.

A second type of Corinthian helmet developed from the habit of wearing it as just described. In this, the helmet was intended to be kept back on the head, and the apertures for eyes and mouth were only a matter of form. Some specimens in the British Museum show mere engravings representing openings in the original face-guard. In most cases, horsehair crests were set on these helmets, to give the wearer an appearance of imposing height.

The earliest examples of Corinthian helmets showed little attempt at contour, but later helmets had graceful curves in the nose- and cheek-pieces, and the back followed the natural contour of the neck. There [redacted] distinct dividing line between the crown and the lower part.

A lighter and less cumbrous form is seen in the Attic helmet, the second Greek type, originally worn in the sixth century B.C. It was like a round metal cap, with defences for the neck, cheek and nose, the ears being left free. The cheek-pieces were usually decorated, and in many helmets they could be pushed

GREEK ROUND SHIELD
From 7th century B.C.

up hinges when not required. This was a well-designed helmet, with good forehead protection and (usually) a triangular frontal band with an ornament. A crest was mounted, but often the nose-piece was omitted, and in the latter form the Attic helmet was general in Greece by the fourth century B.C.

Another essential part of the Greek warrior's equipment was his shield, for thus early were shield and man identified in battle. There were several types of shield in use, but the large round form appears most frequently in paintings and sculptures. It carried the personal mark of the soldier or that of his city-state, and its size allowed him to dispense with the clumsy body-armour if he wished. With helmet, greaves, and shield, he could face his enemy confidently.

According to Herodotus, the Greek round shield, held on the arm by straps and a crossbar, was introduced by the Carians. These were a maritime people of south-west Asia Minor, to whom the historian credits the emblazoning of shields. Before the round form came into use, the Greek shield

was a huge curved affair slung to the neck by a strap, and covering the warrior from head to foot. When armour was adopted, the long shield was no longer needed.

By the fifth century B.C. the Greek *cuirass* or equipment of body-armour was much more convenient. Instead of the old-type rigid metal plates, the warrior now wore ■ leather tunic (Latin *corium*, leather, hence cuirass) with small scales of

PUTTING ON THE GREEK CUIRASS, 5th century B.C.

bronze apparently sewn to it with wire. The scales overlapped so as to present three thicknesses of metal at all points, and curved shoulder-plates were fastened down upon the chest. Our picture, based upon a contemporary vase painting, shows a soldier putting ■ his cuirass.

Throughout their age of conquest, the Greeks chiefly employed the spear and the sword, though the bow and the sling

might be used by men from particular districts, who were serving ■■ mercenaries. During the Mycenæan era, before the rise of the Greeks, the increasing skill of the Ægean bronze-founders had developed the dagger in two main forms. In one instance it was lengthened into the sword and tanged, as already recorded, and the other great departure was the making of *cored* blades. This provided a long socket wherein a shaft could be fitted, so that the dagger became a spear.

A number of long, slender Mycenæan spearheads still survive, the prototypes of the heavy spear employed by the Greek soldier of Homer's day as a casting or thrusting weapon.

As early as the tenth century B.C., iron weapons were replacing those of bronze, though some of the forms of bronze sword were repeated in iron. In general, the Greek sword of the Iron Age was about two feet long in the blade, with a round grip, ■ small knob or pommel, and a plain cross-guard. There were three main types, one with ■ straight blade, another with the recurving edges of the cutting sword, and lastly the *machaira*, a waved weapon with two cutting edges and ■ hilt shaped like a bird. The latter was recommended by Xenophon as ■ cavalry sword suitable for dealing heavy blows. This gives us a clear idea of the difference in strength between the sword of cast bronze and that of forged iron.

However, the iron sword had its drawbacks. Heavy blows with the edge against ■■ armoured opponent could turn the edge or cause the blade to bend. When this happened, the warrior was forced to retire and straighten the sword under his foot!

Greeks

Military training was compulsory in ancient Greece, on a National Service basis. At the age of eighteen, the Athenian youth was sent to Piraeus, the port of Athens, for garrison duty with a course of drill. After a year he was issued with a spear and a shield, provided by his city-state, and another year in garrison on the Attica frontier completed his training. There was a small, highly selective cavalry unit for wealthy recruits, and these, like the others, were on call-up between the ages of twenty and forty.

An Athenian army on service was chiefly composed of *hoplitai*, free citizens forming the main phalanx of heavy infantry, two to four thousand strong. Attendant light troops equalled the phalanx in numbers, but were divided into three classes. *Psiloi* were skirmishers, equipped with little but javelins, and they were usually slaves of the *hoplitai*. Another similar light body had the protection of shields, so they were called *peltasti* (Greek *pelta*, shield). Lastly, there were *gumnetai*, harassing units composed of slaves or foreigners, and variously armed with missile weapons.

Discipline was poor, and the small cavalry force, entirely made up of wealthy Athenians, was not employed as a tactical unit. There was a set disposition for the men of the phalanx, which was eight ranks deep. On the march the interval was six feet, in attack or close order it was three feet, and for defence in locked order one and a half feet.

A phalanx was a solid but unwieldy unit, giving little facility for manœuvre. Its best use was in steam-roller fashion, a slow advance behind a hedge of spear-points. Miltiades car-

ried out a simple manœuvre against the Persians on the Attic battlefield of Marathon, in 490 B.C. He had ten thousand troops, variously defended with armour and shields, against twice that number of Persians, chiefly archers behind propped shields.

As usual, the Persians massed in the centre, and when they advanced they drove back the weak Athenian centre. Miltiades had placed most of his troops on the wings, and these now closed in like jaws. Their defences shielded them from the arrow-storm, and they marched over the lightly-armed Persians, killing six thousand for a loss of two hundred.

The same year saw the birth of the great Athenian soldier Pericles, son of Xanthippus the naval commander. In the course of the period often styled the Periclean Age (460 B.C.–429 B.C.) the fortresses of Athens and Piraeus were linked by the Long Walls, forming a protected road between city and port. Pericles displayed rare ability in combining sea and land operations. On one occasion during the Peloponesean War, he avoided a pitched battle with his opponents' huge force of *hoplitai* by withdrawing between the Long Walls. After a brief siege, poor organisation forced the attackers to begin a retreat, as Pericles had anticipated, so he took a seaborne force ahead of them to harry the denuded Peloponesean coast.

However, through most of the Greek military story, the phalanx played a vital part. Until the late fourth century B.C. the Spartan formation was supreme, a well-drilled body of troops capable of tremendous forward pressure. The phalanx pushed through the opposing force, then cut down its scattered units.

Sparta was the ultra-military state. It was the rule that every fit male became a soldier, and with that in view boys of twelve began a rigorous course of endurance and training. Though there was no national spirit in Greece as a whole, it became the accepted idea that the Spartans were the cham-

pions of the Greek states. This naturally led to a Spartan attempt to control the states, and in 371 B.C. the champions were overthrown.

The decisive battle was fought at Leuctra, in Boeotia, against the army of Thebes, under the command of a shrewd citizen named Epaminondas. As the Spartans always fought in [illegible] fashion, the steam-roller movement, the Theban commander devised a counter-offensive. He staggered his battle line so that the majority of his heavy infantry were massed far forward on his left wing, fronting the strong Spartan right wing.

When the contending armies advanced, the Theban left wing, fifty ranks deep, was first engaged alone, being far in advance. Its crushing onset beat down the powerful Spartan right, and the remaining Theban troops followed up to kill over half their opponents, including the king.

Shortly after this engagement, a student of Epaminandos became the ruler of the rough northern territory of Macedonia. In 360 B.C. Philip of Macedon set out to raise an army of outstanding power that would master the Greek nation. In the first place, horses were plentiful in Macedonia, and the warrior nobles were used to fighting on horseback. This was uncommon at the time, as already remarked, for the greater part of Greece was unsuitable for mounted action.

Philip gave intensive tactical training to a strong force of cavalry to form the wings of his army, while the infantry was the centre. In the *grand phalanx* were well over sixteen thousand *hoplitai*, sixteen ranks deep, and the twenty-four-foot spear (*sarissa*) was gripped six feet from the butt. The spears of the first six ranks formed a hedge of points well in advance of the *hoplitai*. This formidable array of troops became famous as the *Macedonian phalanx*, and Philip drilled the men to form a solid column thirty-two ranks deep, or to extend the front with a depth of eight ranks. It made the unit a

trifle more flexible, but there was no provision for moving sections of troops to strategic positions.

After subjecting all the Greek states but Sparta, Philip was murdered in 336 B.C., and the kingdom was left to his son Alexander, then aged twenty. The latter earned his title "the Great" by his brilliant campaigns in the Middle East. An example of tactics learned from his father was the action against the Persians at the Gulf of Issus in 331 B.C. Though the enemy was strongly placed behind a stream, Alexander carried out his father's attacking policy, with an oblique battle line and the right wing nearest the Persian line. The young king led this unit in a fierce cavalry charge that routed the enemy left. While the opposing centres were struggling, Alexander dashed his shouting horsemen into the unguarded flank, sweeping the Asiatic forces off the field. A disorderly retreat was only checked when the defeated troops had crossed the Euphrates.

Alexander's subsequent progress through the East reads like a fairy story – unfailing victory, brilliant generalship, outstanding personal valour inspiring hero-worship among his men. His meteoric career, resulting in self-exaltation, and death through debauchery (323 B.C.), was the zenith of Greek military glory. Already, in the west, the agents of calamity were stirring.

The Rise [redacted] Romans

Long before the Greeks became a conquering nation, their traders had pushed out in various directions to seek new markets. Only fifty miles from their western shores lay the "heel"

of Italia, and by 750 B.C. Greek colonies were established there. Within a century, there were flourishing cities around the coast of southern Italia, which was then styled "Greater Greece".

The presence of Greek traders and soldiers in the country gave the rough natives the pattern of civilisation and of organised warfare. Until the Greek advent, the Italic warrior had gone out to fight his neighbour in his everyday tunic, guarded with a *pectoral* of tough hide strapped over his chest, the whole topped by a leather helmet. His equipment comprised a long wooden shield, a bronze-headed javelin, and a bronze stabbing sword with a horned hilt slung at his right hip.

With the examples of Greek progress around them, the tribesmen of central Italia began to improve upon their archaic war gear, by means of trading and imitation. It is true that the cost and relative clumsiness of early Greek armour compared ill with the native defences. For this reason, the latter were never completely replaced, but quite early in the sixth century B.C. some warriors of early Rome were equipped like *hoplitai*. While the mud-walled city grew up, and the central Latian tribes gained power through combination, increased wealth led to the greater use of armour. When the old tribal skirmishes had given place to pitched battles, it became obvious that good armour was a vital factor. The early Roman army comprised citizens of varying degrees of wealth, armoured according to their means.

As the Greeks had found, solid body-armour was too restrictive, by the fifth century B.C. a flexible defence was back in favour with the Romans. Bronze scales on leather formed the cuirass, with shaped metal shoulder-pieces and a metal belt. The latter had been worn by the Greeks of Homer's time, and they had evidently adopted it from the Cretan belt, which, among the latter, was everyday wear.

With the scaled cuirass was worn an imposing three-plumed

Attic helmet, and a straight, two-edged iron sword was awkwardly slung under the left armpit. Greaves were still part of the infantry equipment; the soldier of the time of Camillus (early fourth century B.C.) wore them below his metalled leather kilt. His scaled cuirass was guarded by a rectangular metal breastplate strapped on like the old pectoral, and over his upper arms hung metalled strips of leather. At this time the sword hung straight before the right hip, and a javelin and an oval shield with a boss completed the equipment of a wealthy citizen-soldier.

Italic vase-paintings of the fourth and third centuries B.C. frequently show an advanced technique in Greek-pattern body-armour. It produced a solid metal cuirass, freely modelled to follow the contours of the body, to which it fitted closely. The form of the cuirass showed the Greeks' increasing skill in metal-working, especially in bronze.

In order to produce curves corresponding with those of the body, the armourer hammered the sheet of bronze over a

EARLY ROMAN ARMOUR, GREEK FORM: 400BC.

roughly-shaped wooden core. A later stage of the process was to lay the plate upon ■ bed of pitch covered with brick dust, upon which the modelling was beaten out. The pitch bed gave ■ firm yet resilient support, and this method provided some of the finest Greek repoussé work.

The lower edge of the moulded cuirass was curved to the waist and hips, and holes were made around the edge for the attachment of a kilt of leather strips or metal scales. When the long greaves began to go out of ▬ among the Romans, subsidiary pieces were occasionally worn instead – short, narrow shin-guards, bronze ankle-pieces, and even bronze "shoes" to cover the top of the foot. Like the greaves, these pieces usually had holes around their edges for fastening linings.

A number of vases from southern Italy show pictures of a peculiar threefold breastplate made up of three large discs, such ▬ have been found in early Iron Age burials.

These efforts at military progress, and the benefits of combination, created the beginnings of the great Roman upsurge. Feeble, uncertain, and frequently defeated, the Roman people gradually consolidated their position and began to expand. By the beginning of the third century B.C. their increasing power caused serious alarm among the merchants of Greater Greece. As usual, the various Greek cities of the colony had not united in a common bond, so they were ill-placed for defence.

A call for help was sent to Pyrrhus, the king of Epirus, who was a student of the tactics of Epaminandos and Philip of Macedon. The king had an army unparalleled in the western world. His cavalry, mounting Thessalian horses, was the best in existence, he had a highly-trained Greek phalanx, and – rare inclusion – battle elephants, hung with armour.

Pyrrhus twice defeated the Romans (280 B.C. and 279 B.C.), but he was not destined to conquer them. Though he won the battles, Rome still had large unbroken forces, and the king's frustrating experience has given us the phrase "Pyrrhic victory", meaning victory without success. Baffling, too, was the interference of Carthage, the great Phoenician city of North Africa, whose rulers feared that Epirus might be another trading rival, in addition to Rome. A Carthaginian fleet was sent to help the Romans, and the warrior king, unable to inflict a decisive defeat, retired to his own country.

Now the Greek colonists were in a perilous position. Their enemies had improved upon Greek military tactics, to become really formidable. Roman commanders had realised the importance of two great factors in battle – discipline and mobility. In the Roman army, disobedience might incur death, even though the breach had brought good results.

As regards movement, the phalanx was adapted to become a more flexible unit. It was portioned into front, centre, and rear divisions, which were subdivided into sections (*maniples*). The latter were drawn up in staggered formation, so that the

spaces between the front division maniples were covered by the centre division, and so on. In action, when gaps were made among the young vigorous troops of the front division, the older, steady men of the centre and [redacted] closed up in maniples to fill the breach.

For convenience, the Romans disposed an army in *legions*, each totalling about four thousand five hundred men. A legion was composed of maniples with one hundred and twenty men per unit, subdivided into "centuries" of sixty men; the "century" of troops had soon ceased to mean a hundred. In the Roman army the foot-soldier was supreme. Only three hundred cavalry were included in a legion, which contained three thousand heavy infantry and twelve hundred skirmishers. There were no professional generals; the troops were commanded by consuls, but longer service became common when pay was introduced, and by this means a body of experienced officers was formed.

Soon after Pyrrhus' failure, the Greek colonists of Italia were turned out of the country (275 B.C.) but ten years later the long struggle with Carthage had begun. The two great trading rivals of the Mediterranean fought intermittently for more than sixty years. Between 218 B.C. and 202 B.C. the famous young commander Hannibal displayed his skill against the Romans, particularly in his employment of cavalry. At the battle of Cannæ (216 B.C.), in south-east Italy, Hannibal's cavalry routed both wings of the Roman horse, which allowed the Carthaginians to box in and slaughter the Roman army.

The defeated commanders had yet to learn the art of moving bodies of troops into strategic positions. It fell to the able young Roman Scipio to demonstrate this to his countrymen. While Hannibal's fortunes were declining in Italy, Scipio drove other Carthaginian forces from Spain, and followed them to Africa. His successes there forced Hannibal's recall, and the two great commanders met at Zama in 202 B.C.

Hannibal's weak cavalry wings were chased off the field by the Roman mounted troops, as he had foreseen, so his infantry then began a prearranged pincers movement to enclose his opponents. However, Scipio observed the move, and extended his front by pushing out his centre and rear divisions to left and right. Having deployed, Hannibal's men merely found themselves fighting on a line vastly longer than before. A flank attack by the returning Roman cavalry completed the Carthaginian defeat.

This lesson in manœuvre stood the Roman commanders in good stead when they began their conquest of the East. Before the skilful movement and disposition of Roman legions, the rigid Macedonian phalanx was useless, and a smashing victory at Cynocephalæ (dogs' heads) placed Alexander's realm under the heel of Rome. Within thirty years, the whole of the eastern Mediterranean was subjected, and the Roman army moved from strength to strength.

In 101 B.C. the ex-ploughboy Marius raised a professional army on reorganised principles. His legions numbered six thousand men, divided into ten *cohorts* of six hundred. By this means a force of considerable strength, yet not too big for easy movement, could be manœuvred with clockwork precision. The commander introduced a novel practice, that of carrying the kit on a pole over the shoulder when on the march. His men were jeeringly styled "Marius' mules".

By this time we may see that immense progress had been made in military art during the previous two centuries. An army was no longer a clumsy, close-packed mass, but a series of mobile detachments working to a concerted plan. The finest example ever shown to the ancient world was the battle of Pharsala, in Thessaly (48 B.C.). It was the final clash between Julius Caesar and the Senate's champion, Pompey. The latter's right was guarded by a stream, so he ranged all his cavalry on the left, to smash through Caesar's right and attack

his infantry from the rear. Though the break-through appeared to be successful, there was an unexpected turn. In fact, Caesar had directed the cavalry on his right wing to let the enemy drive them back.

When disposing his troops, Caesar had posted six of his best cohorts in concealment behind the cavalry position, and as Pompey's horsemen tore through in pursuit, the cohorts moved across behind them. The supposed fugitives turned about, and the attackers were cut to pieces in the jaws of the trap. Caesar's cavalry pushed on to round his opponent's undefended left and attack from the rear, while all the reserves were thrown into a frontal attack. Pompey's army was utterly broken up and driven from the field, victims of the peak performance in Roman warcraft.

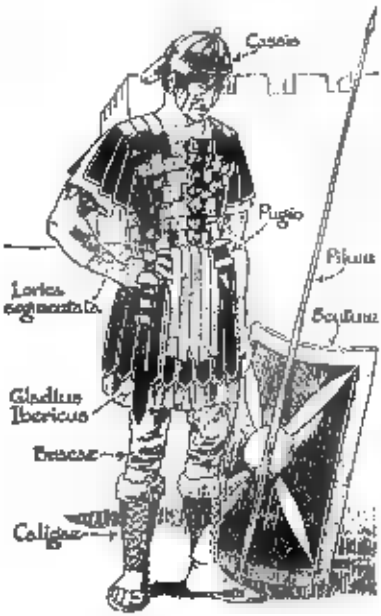
The Standardised Army

Around the Mediterranean shores, the long Roman roads echoed the tramp of the marching legions, units of the greatest army that had ever been known. At the beginning of the Christian era the Roman soldier in the ranks (*hastarius*, i.e., spearman, from Latin *hasta*, spear) was fitted out with almost completely standardised equipment, through the Roman genius for organisation.

Our picture shows the legionary defended by a cuirass made of overlapping iron bands, fastened down the front (*lorica segmentata*), with shoulder pieces similarly formed. His headpiece (*cassis*) was of a pattern combining the Attic helmet and the fifth-century Italic type known to students as a "jockey cap". It had a frontal band, an outstanding neck-guard, and

hinged cheek-pieces. An attachment at the top permitted a plume to be mounted for ceremonial parades.

The thighs and the lower part of the body were guarded by the metalled leather strip-kilt, with similar strips covering his upper arms. An appendage like a sporran, made of three or more leather strips, hung from the front of the regulation belt (*cingulum militare*). Each legionary carried a large rectangular



ROMAN LEGIONARY (1st. CENTURY A.D.

curved shield (*scutum*) of wood and leather, bound with metal and charged with the number and device of his unit. These shields in combination formed a manual "armoured fighting vehicle", for the heavy infantry were trained to lock their shields together in a *testudo* (tortoise) when occasion demanded. In this way they presented a series of defensive barriers.

A legionary's standard offensive weapons were three in number. The thrusting spear had been completely discarded in favour of ■ seven-foot javelin (*pilum*). This had a wooden lower section and ■ long, thin upper shaft and head of iron, four and a half feet long. Before charging, the soldier threw his javelin. If it remained fast in the enemy's shield or body, the soft iron shaft bent under its own weight, the trailing length dangling to hamper the opponent or to aggravate his wound.

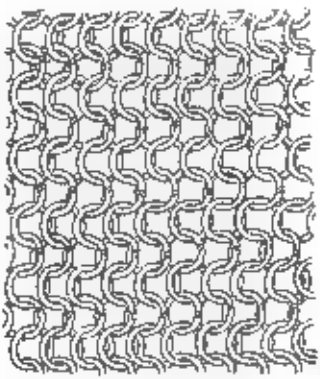
Polybius wrote that the legionary sometimes used the pilum to ward off sword strokes, and that he thereby played havoc with the sword edges.

There was a strange development connected with this weapon. Roman troops in Germany contacted a powerful group of tribes called the Franks, named after ■■ axe (*francisca*) with which they were armed. By coincidence or through imitation, these tribesmen developed the use of ■ javelin formed like the *pilum*, but called by them the *angon*. They used it like the Romans, to hamper their opponents' movements, but they stepped on the butt of the weapon as it trailed on the ground. The *angon* was in common use among the Franks from about A.D. 450.

Though the Romans knew of steel, it was not plentiful enough to be used in quantity, so well-tempered iron was used for weapons. At the legionary's right hip hung his sword of Spanish iron (*gladius Ibericus*), with a sharply pointed twenty-one inch blade. This well-made sword could be used for cutting or thrusting, and its auxiliary was the short, broad dagger (*pugio*), worn at the left hip.

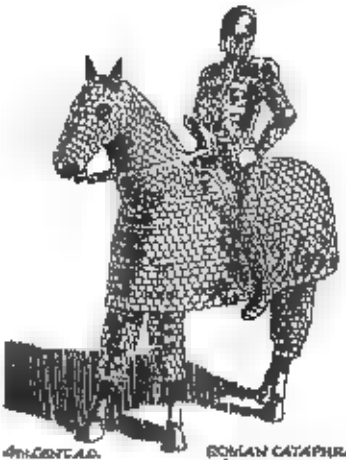
There were some special equipments. Decorative cuirasses of the old pattern were worn by the higher officers. Moulded to the body, these cuirasses bore medallions denoting military honours (*phaleræ*) and were girded with sash-like sword-belts. With this armour was worn the crested helmet (*galea*).

The standard-bearer, chosen for his bravery, had a cuirass of leaf-scales (*lorica squamata*). Over his helmet hung the head and skin of a wild animal, which headdress was also worn by light infantry (*velites*). These troops had only a leather pectoral and a round shield for defence, their weapons being a number of light javelins. Auxiliary infantrymen were equipped and armed on the pattern of the legionaries, except that the former had no javelins, and their defences were all of leather.



Mail

Alternate rows riveted and punched rings.



4th CENT. A.D. ROMAN CATAPHRACTUS (ARMOURED CAVALRY).

One other important feature of Roman armour was the use of mail, though this is very difficult to date or to pin down as to origin. The Assyrians had mail in the eighth century B.C., it seems to have been worn in Europe at least a century before the birth of Christ, and it figured in military equipments until the nineteenth century. Mail consisted of innumerable linked rings that could compose a shirt-like garment or enclose the entire form from head to foot.

Eastern mail was usually made of rings, the ends of which were simply pinched together without riveting, but in most

European examples the ends of the rings were riveted. Sometimes rings were punched direct from a metal sheet, and were arranged in alternate rows with riveted rings, but the usual formation was a continuous link-up of four rings joined by a fifth. One of the most curious points regarding mail is the immense labour that must have gone into a single mail-shirt. Thousands of finger-nail sized rings had to be made from wire, and their ends flattened, drilled, and finally riveted. This indicates some early form of ▬ production.

Lesser defences, like the leather gear of the Roman auxiliary, are examples of the many other types of protection known to the ancient world. These ranged from padded or quilted fabric to garments plated with horn, hardened leather, or metal, in pieces of various sizes. Leather was sometimes hardened with hot wax into what was known ▬ *cuir bouilli*. Though mail seems to have originated in the East, the warriors of that region greatly favoured *lamellar* armour, small metal plates laced together upon a leather or fabric base. This type of defence continued in use until the fourteenth century in Europe, and for centuries longer in the East.

A remarkable experiment by the Romans was the equipment of the *cataphractus*, the armoured horse and rider, in the fourth century A.D. Man and beast were covered with overlapping plates, even to the legs of the horse, and a pierced metal mask covered the horseman's face. This scheme was revived in the Middle Ages, with no more success; a high degree of protection was attained at the expense of unwieldiness.

In the great days of Rome, entertainment was of great importance for public occasions. Prominent among the entertainers were the famous *gladiators*, or professional swordfighters (Latin *gladius*, sword). A number of reliefs and drawings give us a clear idea of the type of armour they wore, and much of it still survives.

ARMOUR AND BLADE

The well-protected Samnite gladiator wore a high-crested, broad-brimmed helmet with a perforated visor, one or two greaves, and articulated (i.e., sliding) metal lames upon his sword-arm. On his left arm was a small shield. Similarly armed was the swordsman (*secutor* or "chaser", from Latin *sequi*, to follow) who was matched against the unarmoured *retiarius*, with his net (*rete*) and trident (i.e., "three teeth").

Throughout most of the Roman world, these gladiatorial shows became a regular feature of the "circus", and there still exist remains on many of the sites where the shows took place.

They range in size from the huge Flavian amphitheatre in Rome (now called the Colosseum) which must have held seats for fifty thousand people, to the tiny example at Dorchester, the Dumovaria of the Romans, in Dorset, England.

Hauberk ▬ Lance

Among the Romans, infantry had been from the first the vital factor in war. Though horsemen were employed ■ good deal, it was ▬ the staunch, disciplined, heavily-armed foot-soldier that Roman commanders relied. Quite often the cavalrymen were semi-civilised allies; Caesar's horse at Pharsala had been chiefly Gauls and Germans. While Rome was fighting her way to the top, her infantry ranks were filled with hardy, toughened troops whose discipline surpassed any before them. However, the fruits of success, with internal strife, gravely lowered this standard. By the fourth century A.D. the Roman army was chiefly composed of mercenaries, for her ease-softened citizens would no longer take the field.

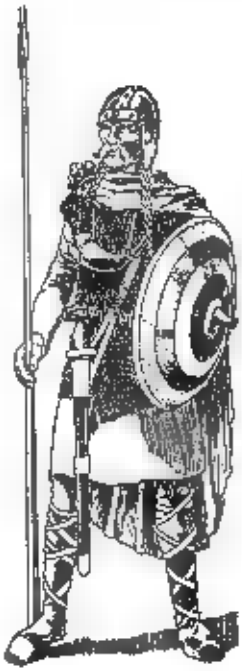
When the invading German tribes were actually threatening the city, feeble Rome had only slaves to send against them. Infantry could face the wild charge of mounted barbarians only when discipline was firm, and the commanders were trusted. The terrible German "fighting groups", each numbering about a hundred men linked by kinship or association, mowed down the hapless Roman troops like corn. Foot-soldiers, long the mainstay of the army, were thrust into a decline by the power of the uncivilised horseman.

The fall of once-mighty Rome drew the legions from their camps in Britain, to return to the homeland. Blackness then descends upon the story of Britain for two centuries, as the hapless nation was engulfed in blood and destruction beneath the ravages of the Saxons. When at last the light comes again, we find seventh-century Britain reverted to comparative barbarism. In place of the disciplined ranks of the legions, a

motley crowd of half-armed farmers held sway over the shattered Britons.

With the collapse of Roman power, the type of plate-armour that they had employed became less common. In the east, post-Empire Byzantine cuirasses were usually of lamellar type, and in the west the Nordic races used mail, through Scandinavian influence. The well-known Anglo-Saxon poem "Beowulf" makes several references to mail, such as "the war-byrnie, his hard battle-net", and the "bright breast-net, hand-locked".

However, among the Saxons armour was not in general use. Only their leaders wore coats of mail, the *gerhynged byrn*,



SAXON WAR HARNESS
c. 650 A.D.

that would turn the edge of a sword but could be pierced by a heavy pointed weapon. For many years it was considered that the Saxon war harness consisted of a leather tunic with flat rings sewn upon it, but modern opinion is that the defence was simply a mail shirt of the usual construction. Its use was restricted to kings and nobles because, apart from being a distinguishing mark of class, the cost of a mail-shirt would have been high. Probably most mail was imported from the Continent.

One type of helmet common among the Saxons was of conical shape. It was formed of four separate iron panels, with vertical iron bands to secure the joins, and a horizontal band around the base. This piecemeal method was necessary because it was a difficult matter for early armourers to forge a one-piece helmet. The swordsmith's craft was well developed among the Saxons, though some nineteenth-century historians misleadingly stated the contrary. Several very fine Saxon swords have been found, such as the example unearthed at Sutton Hoo, in the Anglo-Saxon boat-burial. Among the Nordic races, the sword was a special symbol of honourable service, in that the ruler dealt out swords to his immediate followers, who swore on the ruler's sword to serve him faithfully.

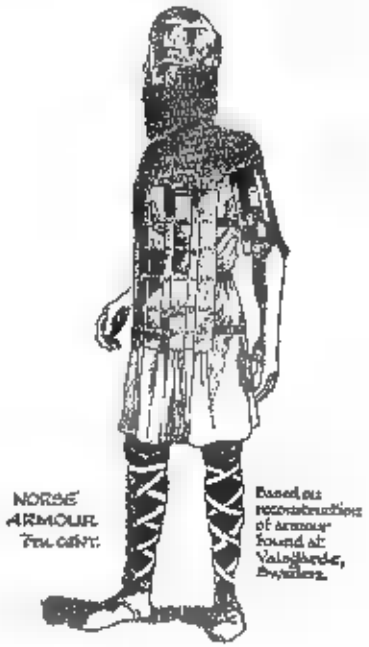
Common to both leaders and bondsmen was the long heavy spear, for throwing and thrusting. Saxon warriors frequently carried two spears, to allow the [illegible] of [illegible] for throwing. Every man carried a large shield, usually of the round type known as a *rondache* or *targe*. It was made of wood and leather bound with metal, and it had a big metal boss in the centre. In its later, smaller form this shield was known as a *target*, a name afterwards applied to the circular mark used for shooting. Possibly a round shield was first employed in this way.

It seems reasonably certain that the Saxons did not use the bow in war, but only for hunting. Accordingly, when they in

turn were invaded by the Northmen, or Vikings, who *did* use the war-bow, they were at a disadvantage. In addition, every Northman was fully equipped with a shirt of plate and mail or lamellar work, and a long straight sword. The double-headed battle-axe that romantics have attributed to the Vikings was rare among them. Specimens of the weapon that have been found were of Russian origin.

The Vikings' swords were of good steel, for they had learnt the principles of carbonising, probably through their eastern contacts in Russia and in the Mediterranean. A massive pommel, triangular and three-lobed, was applied to the sword for balance.

Some examples of Scandinavian armour found at Sutton Hoo, in Suffolk, and at Uppland in Sweden, show a technique far superior to the usual scale-coats shown in conven-



NORSE ARMOUR
Fig. cent.

Based on reconstruction of armour found at Valsgärde, Sweden.

tional pictures of Northmen. The Uppland equipment (A.D. 600–700) consisted of an iron helmet with a fixed visor, from which hung a face-guard of mail. Though the upper part of the body-armour was formed of mail, long strips of plate were attached below it, in Eastern fashion. This harness is dated earlier than the true Viking era (A.D. 800–1050) but it gives an idea of the Northmen's skilful work in armour long before they emerged as conquerors.

A striking feature of Northern tactics was the occasional use of horses to bring warriors to the scene of action, where they dismounted to fight. Those Vikings who settled in the north of France in 912, and founded the state of Northmandy under their Duke Rollo, learned from the enemies around them the technique of fighting from the saddle.

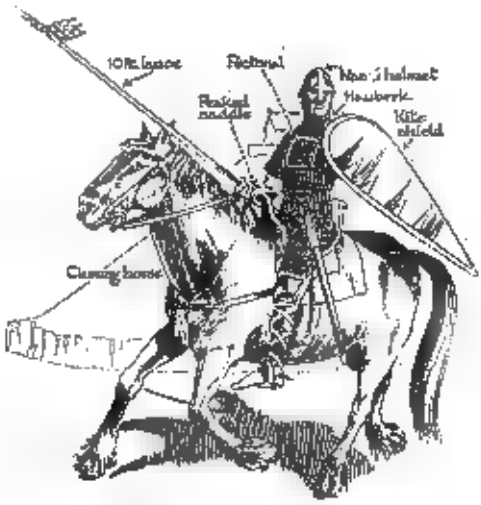
This method of warfare had a long and curious history even at that time. Early in the Christian era, the Scythians of south-eastern Asia Minor used loops of leather to support their feet when mounted. Later developments evolved the metal stirrup, in which the savage warrior braced his feet.

The dreaded Huns, roving across western Europe, led the Westerners to adopt the stirrup, during the declining years of the Roman Empire. Evidently the idea spread, for the Frankish tribesmen of the eighth century are shown, in drawings of that time, riding with stirrups and couching the spear under the arm to charge. The use of stirrups allowed the horseman to brace his feet forward and deliver the point with the weight of horse and man behind it, as he never could have done otherwise.

In this way the transition period was reached. During the time of Charlemagne (A.D. 742–814) the two distinct classes of warrior re-emerged – the superior grade of knight and man-at-arms fighting on horseback and the common soldier on foot. This marked separation endured until the Middle Ages,

when the English archer raised the status of the foot-soldier by reducing the horseman's effectiveness.

Through their progress in arms, the Northmen of France (Normans) paved the way for one of the most important conquests in the world's history. There was little difference between their defensive gear and that of the Saxon *huscarles* at Hastings, except for the round shields of the Saxons. Both sides wore the mail-shirt that the Normans called a *hauberk*, and which they themselves had slit fore and aft for convenience in riding.



NORMAN MAN-AT-ARMS, 11th century

For many years, from the early nineteenth century, the construction of the hauberk was misrepresented. This was chiefly due to Sir Samuel Meyrick, who published his *Critical Inquiry into Antient Armour* in 1818. It was the first specialised study of armour ever made, and Sir Samuel did valuable work in many respects. Unfortunately, some of his conclusions were

misled, and his findings on the Norman hauberk, though frequently quoted, have now been discredited.

The modern opinion is that the hauberk was composed of mail, though the Bayeux Tapestry, worked probably between 1066 and 1082, shows the warriors' defences ▬ variously patterned. This gave rise to Sir Samuel Meyrick's idea that hauberks were chiefly leather garments with reinforcements of leather strips, metal studs, or metal scales, according to the variation of design. It is now considered that practically all the different patterns worked upon the hauberks were conventional methods of showing mail. Possibly a few of the hauberks were intended to represent quilted fabric with metal studs, or leather garments with overlapping scales.

Most of the tapestry warriors wear close-fitting mail coifs or hoods, made in one piece with the hauberk. On many of the latter appears an oblong frame of straps, apparently to secure a reinforcing piece of mail upon the chest, like the old pectoral. Mail leggings and sleeves are shown on some of the figures, though most of them have only cross-gartered hose. The pointed conical helmet was used by both armies. It was well designed to deflect blows, and the protective nasal or nose-piece guarded the face against a cross-blow.

An important item of the horseman's defences was the long, pointed shield with straps and a crossbar inside. It was most awkward to manage ▬ horseback. Though the rider's left side was well guarded, it was very difficult to swing the long shield over the pommel of the high saddle to cover the right at need. In the charge, the horseman carried the shield at his left front, couched his ten-foot lance under his right arm, and followed up with the long Scandinavian sword, two-edged, tapering, and obtusely pointed. Bastons (clubs) and axes with four-foot shafts were used by both armies at Hastings.

Plate-armour Returning

Just thirty years after William's victory at Hastings, the pick of the Anglo-Norman soldiery was engaged in the great mishandled expedition to the Holy Land. The Crusaders who at length captured Jerusalem in 1099 were armoured in hauberks much the same as those worn at Hastings. There were one or two variations, such ■ the close-fitting sleeve to the wrist, and the chin-guard flap known as a ventail. This could be drawn across the mouth and fastened at the side of the coif.

During the course of the following century, increasing attention ■■ paid to leg defences. The horseman's legs and the belly of his horse were points of attack for foot-soldiers. By about 1150, mounted men frequently wore mail *chausses*, in the form of a strip of mail for the front of the leg, with laces for fastening, or as a complete mail stocking. In both forms, the chausses were braced up to the waist, and the whole hose were often gartered below the knee.

Another feature of the fruitless Crusades was the Western warriors' use of long, flowing garments over their armour. These robes were known as *coat-armour* or *surcoats*, and it seems likely that they were designed to keep the direct rays of the sun from the metal hauberks. The surcoat was in use before the middle of the twelfth century, but it was not general wear until after 1200. It does not appear to have been decorated with personal arms, though heraldic bearings were employed from about 1150. This feature of the early Middle Ages became ■■ integral part of military equipment, by which means the members of ■ household or unit could trace each other in the heat of action.

EQUIPMENT OF 1220.

As already noted, the practice of heraldry was of great antiquity. Warriors were using personal or other significant symbols on their shields in the classical age, but the art was only really regularised in the reign of Henry III (1216–1272). Heraldry in the Middle Ages became a special branch of art, requiring a high degree of skill to adapt natural forms to fit irregular spaces, and to accentuate certain features. The mounted warriors, sheathed in mail, so resembled each other that some sure means of distinction was imperative.

It is easy to see that this period was the true beginning of heraldic art, because the standard shield-shape most commonly used in achievements of arms was in the proportions of the contemporary shield – the width was one-third of the height. This form of shield was named "heater-shaped" by nineteenth-century writers, because it resembled in shape the heater of the old box-iron. Heater-shaped shields were in general use among European horsemen from *c.* 1270 until the fifteenth century.

There were accepted methods of rendering birds, beasts, and various objects in heraldic form on the shields, and this meant some degree of distortion and exaggeration. For instance, the heraldic lion resembled no living beast. Its body was purposely made thin and wiry, its claws, tongue, and tail purposely accentuated. This made it a symbol more easily recognisable from a distance in the thick of battle than a naturalistic rendering would have been. There was a purpose, too, in the impression of immense virility and ferocity in the heraldic lion.

As a general rule, colour was never charged upon colour in rendering a coat of arms, e.g., red would not be charged upon blue. Metal was not placed on metal, so that silver would not appear on gold. True heraldry flourished at a very high level until the reign of Henry VII (1485–1509), when the period of its original purpose was coming to an end. As soon as heraldry became a mere decoration, its virility declined. The heraldic painter began to imitate his conventional colleague, producing naturalistic instead of symbolic forms.

At the end of the twelfth century, the mounted man wore either the old conical helmet or a flat-topped type, with or without an open front. The seal of Richard I, Cœur de Lion (1189–1199) shows a completely barrel-shaped helmet, surmounted by a fan-rayed crest and bearing three horizontal slots in front. These flat helmets looked impressive, but they can scarcely have been as practical as other types. They were difficult to attach firmly to the body armour, and a heavy blow on the top would be felt at full force.

Some rounded helmets appear in pictures of this period, with or without nasals. These helmets were plainly made in one piece, hammered out by a skilled blacksmith upon a round-headed dolly fixed in his anvil. Such one-piece helmets were known at least as early as the tenth century; one specimen of that date is preserved in the cathedral in Prague.

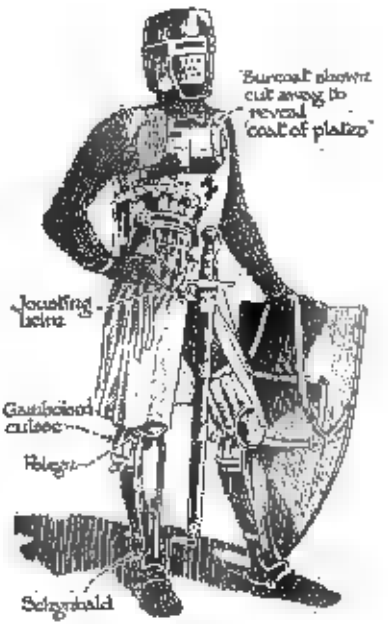
There was never any sweeping, clear-cut change in the style

of head and body defences. Illustrations of the late twelfth century, and the beginning of the thirteenth, show a great variety in that transitional period. For instance, the nasal that was commonly worn at Hastings was still in use long after 1200. Though the solid metal face-guard was introduced about 1180, for conical, round, and flat-topped helmets, a number of warriors of the early thirteenth century still wore the mail coif. However, many of them placed over the coif an iron skull-cap, or *bascinet* ("small basin"). After about 1250, this was often worn under the coif, with a silver or gold band around. This simple embellishment was worn by knights, but of higher rank wore coronets.

Early in the thirteenth century there developed the great cylindrical headpiece called the *heaume* or *helm*. It was based on the barrel-type closed helmet of a few years before – a completely solid defence, flat-topped, with sights and breathing-slits. Reinforcing strips were often applied to the face-guard, and a distinguishing crest was worn. Drawings of the time show a variety of bird and animal devices mounted on the flat top of the heaume, or painted around its sides. Though the great headpiece was a stout defence in itself, it was always worn over a mail coif and a padded covering called an arming-cap. There was a padded lining to the heaume, and it was secured as well as possible by a tied chin-strap.

A horseman's weakest point of defence was still his legs, and in the middle of the thirteenth century an extra protection known as *cuisses* came into use. These guards were fitted over the thigh (French *cuisse*). They resembled thatcher's knee-shields in shape, and they were made of *gamboised* work, a kind of quilted padding that was often used for body-defences.

The next addition to the leg-armour was the *poleyn*, a reinforcing plate that fitted over the kneecap and was attached to the cuisses. At first the poleyns were small discs, but by about 1270 they were curved around the sides of the knees. Below



1250: MAIL AND PLATE.

them were buckled *schynbalds*, long strips of plate covering the front of the chausses. Though plate was occasionally used to reinforce body armour at least sixty years before the above date, it was not commonly applied to other parts of the mail defences until after 1250. Elbow-guards of plate, known as *couters*, seem to have been first worn about 1260.

The monumental effigies and MS. drawings that are such a valuable guide to the armour of the Middle Ages do not show much detail of the body armour of the early mediaeval period. This is due to the continued use of the surcoat, which afforded only an occasional glimpse of the armour beneath it. Sometimes rows of oblong plates were riveted inside the surcoat, or the hardened leather *cuirie* (cuirass), with the occasional addition of plates, was worn under the surcoat. This last defence was developed at the end of the thirteenth century into

a garment variously named as a *hauberk of plates, coat of plates, pair of plates*, etc. It was made up of a number of oblong plates mounted upon a cloth or leather jerkin, and within a few years it had become general wear as a body defence.

These various instances show the increasing use of plate-armour during the thirteenth century, and about 1296 appeared the plated gauntlets that were to endure so long. For the previous hundred years or so, the mail sleeves had been worn extended into a *muffler* to cover the backs of the hands, with a leather inset for the palm and an under-slit for freeing the hand when required. There was a separate stall for the thumb, and a leather strap was threaded around the wrist to give a firm fit. The new gauntlets were made of fabric, with plates riveted on them.

Another item of plate harness that was introduced at about the same time was the early form of *gorget*. This was a solid caped collar, covering the lower half of the face and extending over the shoulders. Thus the man-at-arms had plate defences for his body, elbows, hands, knees and shins. Early in the fourteenth century, this convenience was extended to the feet, when *sabatons* of overlapping horizontal lames were adopted to cover the shoes.

In general, mail defences were most suitable for cavalry, where the circumstance of sitting kept most of the weight of the armour off the shoulders. It was most tiring for the foot soldier to have the mail hauberk hanging from his shoulders.

Some of the work was remarkably fine. A few of King John's horsemen at the disastrous Battle of Bouvines, Flanders, in 1214, wore mail so close and proof that it was impossible to get a dagger-point between the links. However, the bones of the wearer could be broken through his armour.

Though the mail hauberk was a garment in itself, it was very flexible, and it must have been risky to wear it unsupported. A strong thrust or a heavy edge blow could drive the

links into the flesh. The danger was often countered by wearing thickly padded garments, but this bulky lining and the weight of the mail restricted the movement of the sword-arm.

Among the ordinary foot-soldiers, the non-metallic defences were in common use for body-armour. Chief among these was the *aketon*, a knee-length, shirt-like garment stiffened with vertical quilting. The sleeves of the aketon varied between short and wide ■ opposed to long and tight, and there was an upstanding collar. Mounted men used the aketon as a lining for the hauberk, and another form of quilted coat, the *gambeson*, was often worn outside the latter. There was no rule for the inner or outer wearing of these padded garments, and the issue is often confused by the mediaeval writers' use of the term *pourpoint* in this connection. Apparently pourpoint was a general description for any quilted protection.

Equipping the [redacted]

Symbolism was always strong in the mind of the old-time warrior, and the sword was probably the most significant symbol. It has always been the centre of romantic thought; no other weapon has been so singled out for special names (e.g., Excalibur).

Throughout western Europe, as early as the sixth century A.D., there was some symbolic reason for fitting a small loose ring to the pommel of the sword-hilt. It was evident that the practice had some ceremonial purpose. The rings were of various forms and metals, and were always attached by means of a fitting at the side of the pommel. Examples of ring-hilted swords have been found in Kent, England, in Germany, Italy, and Scandinavia. They are not commonly found, which indicates that a ring-hilted sword might be that of a leader.

One important link is that both ring and sword-hilt were objects upon which oaths were sworn, by heathens and Christians alike. In the time of Charlemagne, the pommel might be the receptacle for holy relics, as mentioned in the *Song of Roland*. Thus were combined three oath-taking features—relic, ring and sword-hilt.

By the end of the eighth century the ring-hilt was out of use, but the idea endured for centuries. The ring used in eleventh-century German marriage ceremonies was fixed to a sword-hilt. When the couple touched the ringed hilt it bound them both to loyalty, the man by the sword and the woman by the ring.

Among the soldiers of the Middle Ages, the hallowed significance of the sword endured. A knight's sword was his hon-

our; the early Crusaders used the cross-hilt as a crucifix when they prayed.

During the thirteenth century the cross-guard *quillons* were sometimes made with a slight upward curve. Apparently this was intended to protect the sword-hand in close combat. In fact, it was of little value, and ■ gauntlet was always worn. The sword-blade was broad, double-edged, and slightly tapered, and ■ groove or *fuller* was provided on each face, to lighten the blade without weakening it.

Steel for the blade was produced by a lengthy process known as *cementation*. In the early Middle Ages, iron ore was reduced to a pasty mass of impure iron in a banked-up charcoal fire, and the lump or *bloom* was cut up and reheated for forging.

When steel was to be made, the smith pounded a quantity of the hot iron into small fragments, and put it into ■ crucible with the best charcoal. The mixture was heated, some lumps of iron were added, and the charge was stirred at intervals over a period of five or six hours. By this time the iron had absorbed carbon from the charcoal, and the mass was withdrawn from the crucible to be pounded under heavy hammers.

As the smith was forming the blade he quenched the steel at intervals in water or oil. Carefully produced steel and skilful tempering were rewarded by ■ tough blade that took a keen, lasting edge from the grindstone. Oil and sharp sand were used under a wooden-backed buffer pad to wear down the surface of the metal to a mirror-like polish.

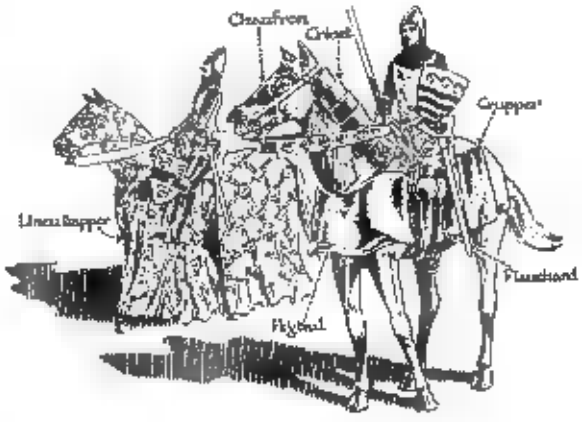
The tang ■ which the hilt was formed was in one piece with the blade, and while the steel was still hot the smith punched holes along the length of the tang for riveting on the side-plates of the grip. These were made of wood or bone in most cases, and were often bound closely with wire. When the quillons had been shrunk on, and the pommel had been added to the extremity of the grip, the furniture of the sword itself was completed. Its scabbard was formed of two slats of wood

suitably shaped to house the blade between them, and secured together by a leather covering. The latter was reinforced by a metal sheath called the *chape*, which guarded the extremity of the scabbard. Two bands were arranged, one at the mouth of the scabbard and one a few inches lower, to permit the sword to be slung to the belt.

Most thirteenth-century examples show the stout sword, with its blade of thirty inches or more, worn over the left thigh, but in the following century it appears slung at the left hip. This was due to the changed form of sword-belt, and the addition of a long, heavy dagger at the right hip. The earlier belt frequently carried the sword by means of a wrap-over sling, but in the fourteenth century something resembling a frog was contrived. In this case the belt, of considerable breadth, was worn low upon the hips, and was often highly decorated. A narrow waistbelt held up the sword-belt.

There was a point to the mediaeval sword, though it can hardly have been used for the thrust. In fact, brute force for slashing was of more value to the swordsman than skill. Meyrick mentions a knightly exercise known as "the attack of the pel". In this pursuit, the trainee swordsman delivered downstrokes on a six-foot post, as if at suitable points on the body of an opponent. It is usual to think of the old-time horseman as having immense advantage over the foot-soldier, by reason of superior speed and lofty position for downward blows. However, the footman was a serious menace, especially the irregular type. For instance, the Welsh tribesmen fearlessly opposed themselves to the English cavalry, plunging in among the hoofs of the horses to hamstring the beasts with their long keen knives, or to stab them under the belly.

This mode of attack was countered by equipping the horse with a drape variously known as a *housing, caparison,* or *trapper*. It was a long skirt reaching to the fetlocks, and made



HORSE DEFENCES, c. 1340.

of reinforced leather, or even of simple linen. Though the horse's movements were rather impeded, the attacker was very much hampered by the hanging material. The idea dates from the middle of the thirteenth century, and Henry the Lion of Germany had his horse equipped with a mail trapper before the end of the century.

Soon after this, another type of trapper was produced, in the manner of the coat of plates. These were all more or less flexible defences, but by about 1260 some horses were protected by *barding* composed of solid plates of *cuir bouilli* or metal. At first only the head and chest were covered, with guards known as *chanfron* and a *peytral* respectively.

An even more formidable irregular foe than the Welsh warrior was the wild Irish axeman. English horsemen fighting in the frequent Irish wars of the Middle Ages found the Irishman a ferocious enemy. A chronicler of the time recorded that the Irish used their long-handled axes in one hand, with the thumb along the shaft. The axeman could shear through the leg of a horseman at a single blow, so that the severed limb fell on one side of the horse and the crippled rider on the other. It was

this kind of attack that made necessary the reinforcement of the leg-harness with plate.

A considerable blow was struck at the supremacy of the horseman by the rise of the English longbow at the end of the thirteenth century. Horse and rider were both in danger before the brawny, lightly armoured archer. Like most English and European foot-soldiers, he preferred freedom of movement to heavy, stiff protection. He wore a light iron skull-cap (*cervellière*), and some moderate body defence such as an aketon, or a coat of plates with leather sleeves. An extra leather cuff called a *bracer* was worn on the left forearm to take the rub of the bowstring in shooting.

The thirteenth century was the prelude to a period of great changes. Though mail had been the chief defence for centuries, superimposed solid armour was steadily building up. Still, mail continued in use as a secondary protection for some time. It was probably made on a production-line system. When the rings were not punched from a metal sheet, they were made by winding wire around a rod, the diameter of which governed that of the rings. Each turn of the wire was cut through, and the rings thus formed were annealed (heated and slowly cooled). The ends of the rings were then flattened and punched for rivets. There must have been a great number of ring-makers doing the work at home; the merchant supplied the wire and collected the work, in the same way as with the mediaeval nail-makers. Presumably the actual armourers received their directions as to measurements and pattern, and it is not unlikely that the mail was built up on some kind of dummy for convenience in working.

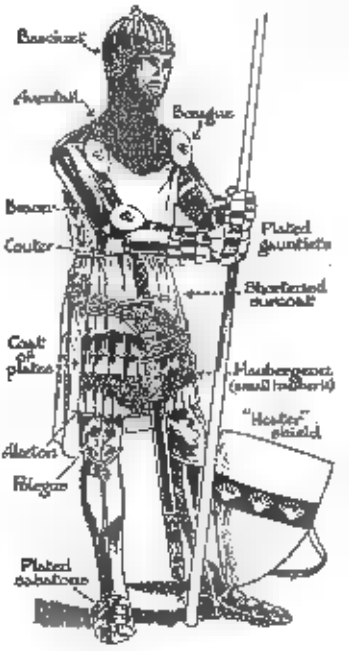
A noticeable feature after 1300 was the use of long plates curving half around the forearm and upper arm, with a cup-like couter for the elbow. A similar couter-like plate, called a *spaudler*, was attached to the shoulder of the hauberk, and the whole assembly of plates was known as a *bracer* (not to be

confused with the leather bracer of the archer). Sometimes the parts of the bracer were separately named. The upper and lower arm-guards were called *rerebrace* (French *arrière-bras*, "behind the arm"), and *vambrace* (French *avant-bras*, forearm guard). These terms were not always precisely applied; in the later fourteenth century the whole arm defence was called ■ vambrace. Further attachments to the bracer were circular plates, called *besagues*, that were laced to the front of the shoulder and the outside of the elbow.

Though the hauberk was still commonly worn, its form was varied into a shorter pattern with cutaway sides – the *haubergeon*, or lesser hauberk. An additional mail collar, stiffly made with stout rings, was known as the *pizaine*. Until nearly the end of the fourteenth century the coat of plates was the main body defence, and sometimes the upper part was combined into a solid breastplate. Some fighting men had rivets on the breast of the body armour, to which were attached guard-chains to retain the sword and dagger. A similar chain was often used for the helm, so that the latter could be slung over the shoulder if desired.

During the first thirty years of the fourteenth century, there was ■ great deal of progress in leg-harness. One of the most important points was the use of enclosing greaves, hinged in two parts, for the lower leg. When they were allied to plate cuisses and sabatons of overlapping horizontal plates, the lower limbs were well protected. At the same time began the use of fan-shaped wings on the outer sides of the poleyns. Variations and improvements were made, but ■■ more actual pieces of armour were added to the harness during the greater part of the century.

As already noted, mail was still important, and a knight of the early fourteenth century wore a complete mail defence under his plate armour. His under-garments were a waist-length close shirt, laced to short breeches, and long hose. The



PLATING OF 1320.

mail chausses were drawn on first and secured at the waist; then followed the cuisses, gamboised or plate, with the poleyns, and the lower leg-armour of schynbalds or greaves. Sabatons and spurs completed the equipment of his lower limbs. He then passed over his head the aketon, to be settled comfortably before putting on the haubergeon, to which his bracers and besagues were already attached by laces and tabs. A coat of plates was then buckled around him, and over all was placed the surcoat, girded with the broad hip-belt. Last of all came the bascinet and plated gauntlets.

At this time (about 1330) it was usual for the armoured horseman to wear a tippet of mail (*aventail*) attached to the lower edge of the bascinet and hanging over the shoulders.

This idea was evidently derived from the old practice of wearing the bascinet over the mail coif. At first the aventail was attached inside the helmet, but a better arrangement was a number of staples riveted around the edge of the bascinet. There were corresponding rings on the upper edge of the aventail, and a cord was threaded through the whole to form an easily detached fastening. Sometimes the lower edge of the aventail was laced to the surcoat. The general effect was like that of the modern "Balaclava helmet", for the aventail covered the cheeks and chin, leaving the face bare only from the corners of the eyes to the lower lip.

During the last few years of the thirteenth century, the great war-helm had undergone some changes, both as to shape and fitments. Its former flat-topped line reverted to the more practical conical design, and its lower edge reached the shoulders, with a point extending down the chest. By 1300 a movable *visor*, that could be pushed upwards, was attached by side pivots to the helm. Surmounting the massive headpiece was an imposing crest, having reference to the wearer's family arms, and a cloth mantling was often worn hanging from the base of the helm.

A strange accessory was to be seen in the equipment of a noble warrior between 1270 and 1350. This was a pair of small vertical plates, usually square, which were laced to stand up on the shoulders. They were called *ailettes* (little wings), and their purpose seems to have been heraldic or ornamental, as they were made of material too flimsy to provide extra defence. Ailettes appeared in picture and text only during the period named, and seemed to be only a rather pointless fashionable adornment.

Armoured in [redacted]

The knightly practice of jousting brought about a variation in the form of the fourteenth century lance. Though the war-lance remained for a time as a simple spear, with a fourteen-foot shaft of cypress wood (formerly ash), that used in mock combats was provided with a hand-guard. It was a small round plate, later named the *avant-plate* (vamplate).

Tournaments, or contests between groups of riders, were well known on the Continent long before the time of William of Normandy (1027–1087), but they were not held in England until the reign of Stephen (1100–1135). The idea was evidently introduced from France, for the *conflictus gallicus* was mentioned in the thirteenth century by Matthew Paris.

At first, the tournament consisted of a *mêlée*, wherein a party of riders attempted to unhorse another party or to knock off their crests. This was the true tournament, for the joust was really a combat between two riders. These early contests, though apparently intended as sport, caused many deaths that in 1130 tourneys and jousts were forbidden by the Church, without effect.

An effort was made to reduce the loss of life by rebating or turning back the lance point, and the idea was further developed by fitting a crown-shaped head (*coronel*) instead of a point. By this means, combats in the lists separated into two forms. One was a strictly supervised formal meeting, not an ordinary trial of strength nor a legalised duel; it corresponded to the modern exhibition bout in the boxing ring. The other type of encounter was the joust *à outrance* with pointed lances

and edged weapons, wherein the combatants fought to kill, as in the trial by combat.

A pointed lance was used in sport only for such pursuits as running at the ring, i.e., trying to carry off a suspended ring on the point of the lance, or for the *quintain*. The latter was ■ pivoted horizontal arm mounted on a tall post; it had the target board at one end and a sandbag at the other. If the rider's lance point struck the target hard and true, the sandbag was whirled around by the blow, to knock him from the saddle if he was not quick enough to avoid it.

This sport still survives in village fêtes, being sometimes varied ■ *tilting the bucket*. A tall erection like a swing-frame has the top bar pivoted to turn ■ its ends. On this bar is balanced ■ bucket of water and below hangs ■ board with a hole in its centre. In this sport the "lancer" is clad in oilskins and rides in a wheelbarrow, the driver of which is similarly clothed. The barrow is driven forward at a run, while the lancer tries to send a long pole through the hole in the board below the bucket. Should he strike the hanging board instead, the bucket is tipped over to empty itself upon the pair.

During the fourteenth century the provision of *bards* or horse armour had developed (see p. 56). Early in the century oblong plates were slung over the crupper, after which they were named, and broad plates called *flanchards* hung from the edges of the saddle. Spiked chanfrons were in production, some of frontal type and others completely enclosing the head, with hoods above the eyes and tubes to enclose the ears. Over the neck was ■ structure of laminated curved plates, called a *crinet*. At first the crinet only covered the crest, but after about 1400 the neck was sometimes wholly covered with mail or plate.

Though bards were apparently in ■■ until well into the sixteenth century, they do not seem to have been of any practical value. It appeared that the extra weight (60–70 lb). and

impediment to movement were not worth the degree of protection afforded, and bards must have been seldom [redacted] the battlefield. In knightly exercises, such as the tourney, it was forbidden to strike at a horse, so in general, barding was needless, except for display. There was a further development about 1460 into the solid all-round defence that is often [redacted] in sixteenth-century examples.

One or two practical devices were applied to the horse's normal furniture. From about 1470 the high-pommelled war-saddle was faced with steel plates, and Italian war-horses often carried steel bucket-stirrups. This was of value to Italian men-at-arms who wore mail sabatons.

As our story moves into the second half of the fourteenth century, we see further changes towards a complete personal defence of plate-armour. This is noticeable in the development of the body-armour from the coat of plates to the solid breast-plate and backplate. During about thirty years, from 1340 to 1370, the structure of riveted plates became, first, [redacted] solid plate over the chest, with plates below it. Next, the solid defence

extended to the waist, and finally to just above the hips. A skirt of hooped plates, known as the *fauld*, was riveted to a cloth cover in the old manner.

There was no clear-cut change. Older and transitional forms held on for many years, but those men who adopted the new solid breastplate presented a distinctive waisted outline. Curiously, the obsolescent coat of plates was converted to give the same line under the close short *jupon* that had replaced the surcoat by 1350. The latter had been worn in a cut-away form, shortened in front, early in the fourteenth century, and after 1340 the skirt had been shortened evenly all around. Though the name jupon was more correctly used for a civilian garment, its military counterpart was often called by that name.

An early form of solid breastplate seems to have developed

ARMOUR OF 1370, with JUPON.
Solid breastplate, with fauld
(hip defence of radial hoops).

quite independently, without deriving from the coat of plates. Several entries in a list of Edward III's armour specifically mention breastplates, and a breastplate for the joust was in Dover Castle in 1361. Some thought was evidently being given to defensive measures that would increase armour's efficiency. For instance, by 1390 a V-shaped ridge of metal was applied below the neck-opening of the breastplate, to prevent the point of an attacking lance from sliding up to the throat. This *stop-rib* was widely adopted, and similar ribs were applied to arm and leg armour.

While this progress was being made, solid armour was being extended to the gauntlets. Until about 1350 they were made in the manner of the coat of plates, but they then developed into a large flared type, with a single plate forming cuff and hand-guard. Small overlapping plates stitched to a leather base covered the fingers and thumb. A leather glove was sewn inside the assembly, and the knuckles were sometimes armed with short spikes called *gadlings*. It was a common practice to cover armour with a fabric casing; the term *white armour* was applied to plain polished armour with no covering.

In spite of the advance in solid defences, armour composed of small plates remained in use for one purpose or another during the fourteenth century. It was usual to make the cuisses of plates riveted to fabric, and sabatons were occasionally made in this way. One favoured piece of body-armour of this type was the *brigandine*, which differed from the coat of plates in having much smaller plates and greater flexibility. It was most useful to archers and other light troops.

At the end of the century two interesting developments had taken place. The most obvious was the increased size of the shoulder-guard previously called the spaudler. This had figured in 1300 as a small cup-shaped extra defence for the point of the shoulder, but in 1400 it had become a large curved plate, one of which extended over each side of the chest and back. It

is known to us ■ a *pauldron* (French *épaule*, shoulder) and it was the most practical form of shoulder defence. It masked the joint, and provided a valuable reinforcement and deflective guard for the breastplate.

The other important feature was the evolution of the solid back-plate to match the breastplate. Probably the former was developed from the coat of plates, though the concealing surcoat renders this uncertain. From about 1400, solid defences were worn ■ the back, and the regular back-plate was in use by 1420. It was fastened to the breastplate by side and shoulder straps, so that the soldier's body was enclosed in a solid shell of metal.

These various pieces of hammered metalwork called for ■ collection of forms on which the required shapes could be beaten out. At this stage, of course, the work was no longer done by ■ blacksmith, but by the specialist armourer who had developed from the craft.

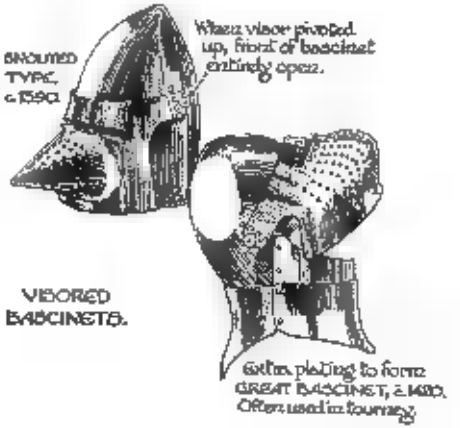
There were many considerations in the successful making of armour – maximum protection by strengthening at vulnerable points, easy fit to avoid oppression, provision for free movement, convenient and durable fastening devices, diverting surfaces where possible, and the skilful turning of edges to give additional wearing properties. The last-named process was done with heat, the edge of the piece being rolled over a wire, but a great deal of the work was hammered out cold, and annealed at intervals. From the fifteenth century onwards, some workers appear to have case-hardened their pieces, probably by heating them in contact with charcoal.

It was during the fifteenth century that the armourer began to display the fruits of the work done by generations of his kind. Throughout the previous century, as the craftsman developed his mastery of the material, the increasing use of plate-armour followed. The period of artistic decoration was still to come, but this was the age of the practical viewpoint and the

workmanlike approach. Mail did not go out of use in the West until the seventeenth century, but its employment as a main defence declined after 1350.

Gussets of mail were used by armoured men to guard the joints of the plate equipment. This was usually done by means of an *arming-doublet*, the fifteenth-century offshoot of the aketon. Pieces of mail were attached to the doublet, by means of *points* (laces), to shield the areas not covered by the plate defences. There was usually a stiff collar, and there were gussets at the armpits and inside the elbow-joints. Sometimes the mail protection comprised a pair of sleeves with armpit extensions, or close mail breeches.

Padded linings were employed in various ways to prevent the armour from chafing, and extra wrappings were put around the knees to shield them from the rub of the leg-harness. Under the helmet was worn a quilted *arming-cap*, a padded roll around the head, with a broad chin-strap to save the cheeks from being rubbed. Usually the helmet was padded with wool or hair, and lined with canvas. The lining could be adjusted to fit the head by means of a drawstring inside the top of the helmet.



During the fourteenth century there had been constant efforts to devise a practicable visor for the bascinet. By 1380 a general form had been achieved that completely covered the face-opening left unguarded by the headpiece and the aventail. A transitional German type, called a *Klappvisier*, was lifted on a hinge set in the brow of the helmet, and it had long horizontal sights and air-holes. From this developed the visor, with side pivots, in the snout-like shape that is ■ characteristic of the early fifteenth century.

With this addition, the tall, pointed bascinet became the most commonly-used headpiece throughout Europe, and about 1400 a bevor of plate was developed from the old pattern, to replace the aventail. Ultimately the bevor became an integral part of the helmet, to form what was later called the *great bascinet*.

At about the same time appeared a great helm specially designed for the tournament. It had a rounded top and a projecting lip in front of the sights, with metal straps at front and rear for securing the helm to the body-armour. As with the bascinet, there was an inside band with a number of dart-shaped strips of leather that could be brought together with a drawstring to fit the head. Though crests were going out of use by the early fifteenth century, they were still retained for jousting helms.

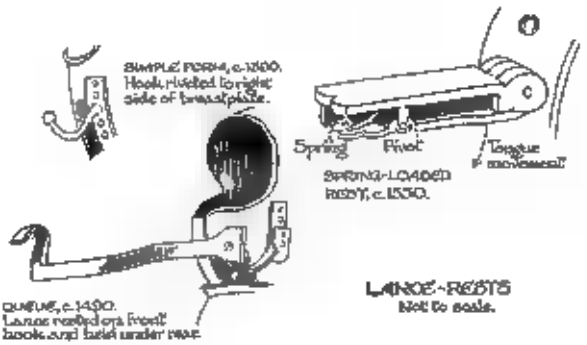
■■■ for ■■■ Combat

It had been customary for centuries to ■■ the tournament as a means of practice in arms. Here was the testing-ground for the proving of armour and the temper of weapons, as well as the skill of the combatants. Previously the lance had been a

plain spear with a vamplate, but during the late fourteenth century the shaft was made in gradually increasing thickness from the lance-head to the hand-hold. A narrowed section was arranged to form a grip, but the increased weight of the lance made some other provision necessary.

At the right side of the breastplate, below and before the armpit, a hook was fixed to help the horseman to support the lance. This lance-rest was later furnished with a *queue*, a bar extending behind the armpit and carrying a reversed hook. In this way the whole weight of the lance was supported by the two fixtures. Though the lance-rest seems to have been in use by 1380, it did not become common until thirty or forty years later. Another means of rendering the jousting-lance steadier in rest was to lighten it by making it hollow. This had the advantage that the lance would splinter in a spectacular fashion on striking its target.

In order to give the greatest power to the impact of the levelled lance, the horseman had to be perfectly rigid in the saddle. Each combatant aimed for his opponent's throat, covered by the massive heaume, in an effort to catapult him from the saddle. The stirrup leathers were long, to allow the rider to brace his legs forward at full length, with straight knees and his feet well home in the stirrups.



In this way, with the legs forward, the body braced against the cantle of the saddle, and the lance firmly in its rest, there was a tremendous shock when the point struck its target. It often happened that both lances struck home but both riders sustained the shock, and the lances were broken. On some such occasions the contest devolved into a *passage of arms*, as the contending pair dismounted to fight on foot.

Towards the end of the fifteenth century, it was not so simple to dismount and fight. The sabatons of this period were made with extraordinarily long toes, in imitation of a civilian fashion. It was so difficult to walk in these sabatons that the armoured man mounted without the long toes, which were fixed on with locking pins when his feet were in the stirrups.

One of the most common objects in the tourney was to unhorse the opponent. This entailed some rough treatment, and various items of special equipment were devised. Just as the American football player tries to safeguard himself from injury by various pads and strappings, the mediaeval joust contestant provided himself with extra protection.

First on the list of necessities was the big tilting-helm of the form previously described, with a frog-mouthed appearance. In England and France the mid-fifteenth century equipment was based on ■ cuirass or a brigandine, to which additional pieces could be strapped. At the left side were ■ pauldron and a *main-de-fer*, a rigid defence for the hand and forearm. There was a gauntlet on the right hand, and the right pauldron had a big round besague before it. On the vambrace was ■ broad, shell-like guard that covered the elbow and part of the upper arm. A small shield with ■ inner buffer was slung on the left side.

German jousting provided for two main types of combat, unhorsing and lance-splintering. In the former practice the knight was virtually standing upright, on a deep-saddled

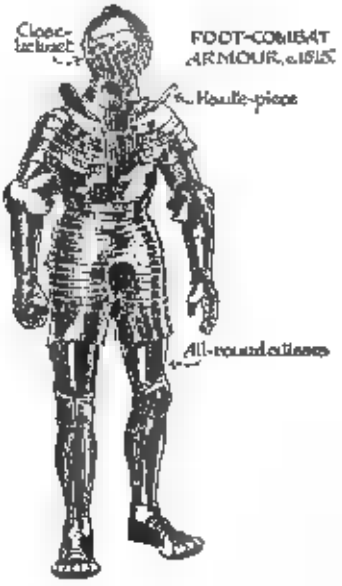
equipment with supports across the backs of his thighs. Some weighty pieces of extra armour were employed. A heavy breastplate, with ■ lance-rest and ■ long queue, had attached below a central plate, over which was fixed a *plackart* or extra plate.

Another special body-defence was made of wood, leather, and metal, to be screwed to the breastplate, while heavy boots and large iron saddle-plates guarded the legs. It was not until the early sixteenth century that such large pieces were worn for English jousting, when the *grand guard* was employed. This was fixed on the left of the breastplate, extending partly over the right half, and it was often combined with a reinforcing bevor. A *passguard*, or large extra defence for the left elbow, was worn with the main-de-fer.

One form of jousting introduced in the early fifteenth century was practised at a long stout fence draped with ■ embroidered cloth known as a *tilt*. The combatants approached each other along opposite sides of the barrier, each man with his left side to the latter, and his lance levelled across his horse's neck (see Frontispiece). Only this form of encounter could be correctly called *tilting* (through the use of the tilt). Though tilting could be described ■ jousting, not all jousting was tilting; only the encounter at the barrier was so named. This sport was adopted by most European countries except Germany, where tilting did not gain favour until the next century.

In foot combats, occasional use was made of the two-handed sword. This was a formidable weapon in powerful hands. The swordsman took the long hilt in both hands and whirled the sword horizontally, scything down his opponents with the great blade, four feet long or more. An old ballad says of a two-hand swordsman in battle:

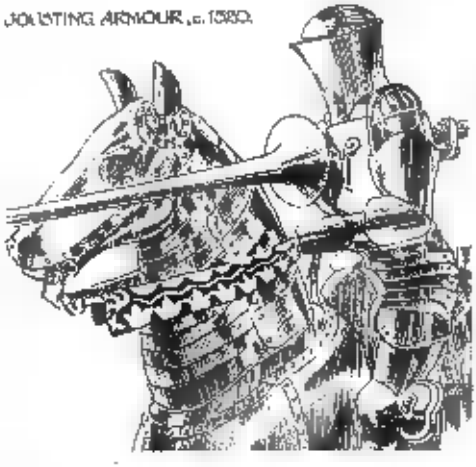
> "With his two-hand swerde he made such playe
> That sixty lay upon the field."



The German *Landsknechte* (a standing army) were sometimes pictured with this weapon. It was too clumsy for general use, though it became the national weapon of the Scots, the *cleadheam mor*, "great sword". This name, corrupted to *claymore*, has been wrongly applied to a basket-hilted broadsword of the eighteenth century, whereas the true claymore had only plain quillons.

There was a lesser blade known as the *bastard* or hand-and-a-half sword, and a third type peculiar to the period was the *estoc* or arming-sword. The latter was a long, tapered thrusting-sword that was often carried naked by a ring at the belt, or at the pommel of the saddle.

Those contestants who fought on foot in passages of arms wore ordinary service armour, with great bascinets strapped on. There was a tendency, in foot-combat armour after about 1500, to enclose the thighs in all-round cuisses, and to employ helmets that locked over the rim of the collar. This provided



JOUSTING ARMOUR, c. 1580.

an entirely unbroken surface of steel, for the joints were filled in with laminated plates.

Entries for the tournament were strictly examined by the heralds, for only men of birth were permitted to take part. In the lists a tree, natural or artificial, was hung with the shields of the champions, and each challenger selected his opponent by touching the latter's shield with his lance-head. On the last day of the tournament the elected Queen of Beauty gave prizes to the victors, and a great feast followed.

Armourer's Heyday

After two centuries of steady progress, the equipment of the armoured man had reached a thoroughly workmanlike and practical standard. In fact, the fifteenth century saw the highest peak of the armourer's craft. Plate defences were provided

to cover the head, body and limbs with well-designed and manageable pieces. Though mail was extensively used to fill in, sliding plates could be used with good effect. The wrought iron employed was often brought to a state almost equal to modern tool steel.

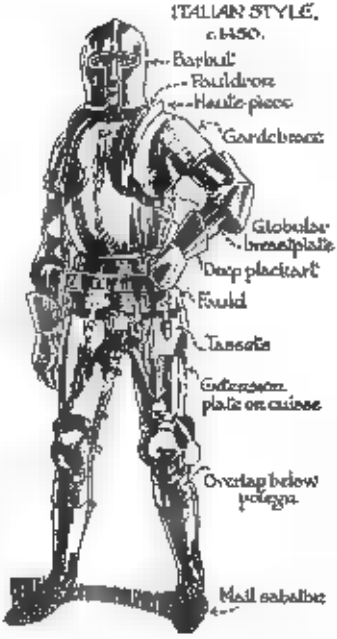
Mediaeval manuscripts show in their illustrations the common use of armour, though it was not really easy to obtain. Armour was always dear, because in the early days of plate the craftsman demanded a high price for his work, being of peculiar difficulty. When he became highly skilled at beating out the various pieces, and perhaps doing decorative work on them, he required an adequate reward on that account.

A good deal of armour was doubtless made in England, but the best work came from the Continent. Italy, in particular, had been important since the thirteenth century, through the rise of the armourers of Milan. That city was enjoying a flourishing trade in armour and weapons by the end of the thirteenth century, and this continued throughout the greater part of the armour-wearing era. It is difficult to find a reason for centralisation in Milan. Italy was then, as now, poor in natural resources, and there was no great amount of water power in the Milan district. However, the fact remains that Milanese armour was supreme, especially that made by the Missaglia family.

Not all Italian armour was made to national designs. The craftsmen studied the export trade to the extent of making equipments in the German style, for instance. These were accepted in Germany in spite of the great armour industry already existing there. Though Germany probably exported more armour than Italy, and German "Gothic" armour was well-designed and ornamented, most European countries were influenced by Italian styles, to which the term "Gothic" is often applied.

We need not delve exhaustively into comparisons between

the two nations, but one or two German characteristics could be mentioned. For instance, in the mid-fifteenth century, German knights often dispensed with the sword-belt, and attached sword and dagger to loops on the fauld. If the latter was too flared for the scabbard to hang straight, a hole was cut in the edge of the fauld. Another noticeable point in German armour



is the inclusion of laminated plate sabatons, pointed like the civilian shoe; the sabatons were never formed of mail.

After about 1430, the jupon was abandoned, though cloaks and tabards with armorial bearings were worn on occasion.

A well-equipped fighting man of the period had an Italianate armour, with a round, waist-length breastplate reinforced in the lower part by an extra plate called a *paunce* or *plackart*. This plate, only a few inches deep, curved to a point in front,

and was fastened by a central strap and buckle. There was a similar arrangement for the back-plate.

Attached below was the fauld, with it lower hoop separated into two parts by a semi-circular gap in front, and further divided at the sides. A single half-round narrow plate formed the rear of this lower hoop, and all three plates were attached to the hoop above them by straps and buckles. Being thus separated, the two front sections were called *foretasses* and the rear plate was ■ *hindtasse*, though *tasset* is the modern term for the former. They were extended further down the thighs, to attain a triangular form by about 1450, and they were sometimes worn with small side tassets. By 1450 the whole assembly of body-armour and fauld was hinged on the left and buckled together on the right.

Upon the shoulders were the large rounded pauldrons, which had proved the most effective guard in this respect. They varied little during the whole of the fifteenth century, though by 1430 the inner edges of the pauldrons were turned up ■ *haute-pieces* to protect the neck from a side-stroke. An occasional addition was a large plate, round or oblong in form, fixed before the left pauldron. In the middle of the century this idea had been developed into *gardebraces* fitting partly over each pauldron, and bearing the haute-pieces. The latter were made larger, until by 1500 the left haute-piece stood as high as the ear.

Though the vambraces were basically the same as before, there was a tendency to elaborate the couters with long, shell-like plates, and to enclose the arm entirely. The same may be said of the leg defences, whose form had been set by about 1370, when the cuisse was made of a single large plate, curving well around the outside of the thigh. Further protection was given by a hinged plate running the length of the cuisse on the outside, a device that endured until the end of the fifteenth century. The back of the thigh was unguarded; straps

securing the cuisse passed around the hose, and ■ leather tag and lace fastened the cuisse to the girdle. By means of a rivet on each side, the poleyn, with its large side-wing, was fastened to the cuisse, and below the poleyn was ■ deep plate, attached by a narrow lame, to overlap the top of the greave. This was formed ■■ before, in two parts, hinged on the outside and buckled on the inside, with its lower edge shaped over the ankle-bones and instep.

The foot-soldier of the fifteenth century relied a great deal upon fabric-and-metal defences, topped by a bascinet, a kettle-hat, or a *sallet*. This last-named headpiece was of Italian origin, and in its true form was ■ deep, slightly bell-shaped affair with ■ pointed neck-guard and with long horizontal sights in the fixed visor. As worn by the foot-soldier, it was shallow, and looked as if it could be easily displaced, but it was so popular that it must have been satisfactory.

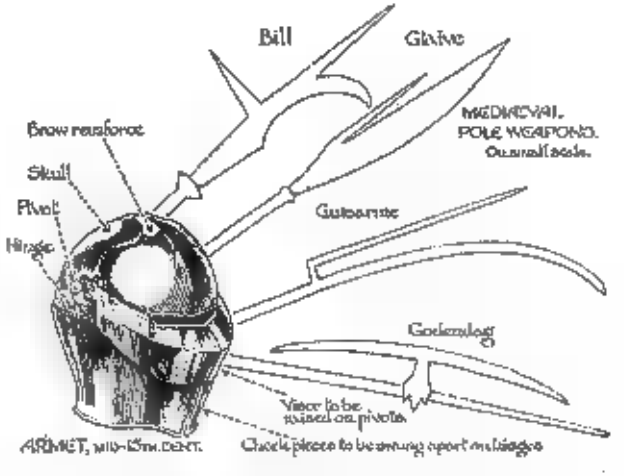
During the last twenty years of the fifteenth century two additional forms of sallet were adopted, both being Italian types. First came an open pattern, running back in a steep slope from the brow to the extended tailpiece, and the next sallet had a pivoted visor that completely enclosed the face. Another popular form of light helmet was the Spanish *cabacete*, a tall, narrow piece with ■ turned-down brim that came to an upturned point fore and aft. Spanish soldiers often wore the cabacete with a large bevor that practically covered the face, and its gorget-plate extended well down the chest.

Commonly worn among the infantry was the *jack*, a rough canvas garment with plates of metal or horn sandwiched between layers of the material and stitched in. It was laced down the front, with a strip arranged inside the opening to cover the lacing cords. This defence was a cheaper version of the brigandine, and it had been in use since the previous century, at least.

Occasionally some piece of plate reinforcement was added,

but always to the upper parts; not so much attention was paid towards arming the legs, for two reasons. First was the fact that the foot-soldier's greatest menace was the horseman, whose blows [redacted] from above. Secondly, and more obvious, was the reason of free movement, already noted as regards the archer.

In addition to the fifteen-foot pike, a number of different pole weapons were employed by the foot-soldier, such as the English *bill*. This frightful weapon had a threefold provision



– a hook to drag the horseman from the saddle, a spike to stab him, and an edge to hack him. Similar in general purpose were several others – the broad-bladed *glaive*, the scythe-like *guisarme*, and the Flemish *godendag* (literally "good-day").

All these weapons were designed to counter the cavalry attack, after the horsemen had braved the archers' arrow-storm. For his part, the man-at-arms had to dash himself and his mount against the formidable barrier of points presented by the billmen and pikemen. The latter's technique was to incline the pike at an acute angle, with the butt against the

ground and clipped under the right instep, the arms being almost straight. This gave ■ rigidity to the point that made the stance highly effective.

In advancing, the pike was *charged* or held horizontally level with the chest, with the right arm extended behind and the left arm well forward. This was done when an objective was to be gained "by push of pike".

An interesting feature of this infantry arm was the resem-

blance to the classical phalanx. All Europe owed to the Swiss the practices of disciplined pike action, first employed during the fifteenth century. There had been formations of massed spears ■ ■ anti-cavalry defence on European battlefields for two centuries, but these were rigid units with little mobility. The Swiss pikemen, and later the German *Landsknechte*, formed up in the Macedonian style, but were trained in tactical manœuvring.

A difficulty with the pike was that if the hedge of points became broken, and the cavalry broke in among the troops, the long shaft was simply ■ encumbrance. In such case the

rider would use his close-quarters weapons, his sword, or the spiked mace known as the *morgenstern* (Flemish, "morning star").

During the early fifteenth century the shield went out of use among mounted men. After 1450 it was hardly ever used, except in the lists or for parade display. Infantrymen still used small targets, and the bowman retained the large sheltering *pavise*.

We have seen that the bascinet was in common use throughout the fourteenth century and well into the fifteenth. Early in the fifteenth century there appeared a variation of this useful headpiece, which was known ▬ the *armet*. It was a closed helmet formed in four sections – a rounded cap, cheek-pieces that were hinged to meet and fasten under the chin, and a pivoted visor to cover the face.

By the middle of the century an additional defence had been introduced. This was a reinforcing bevor, or *wrapper*, which fitted around the cheek-pieces of the armet and covered part of the chest. A buckled strap secured this piece to the helmet.

The Declining Years

Though the armour of the closing mediaeval era was excellent of its kind, both as regards material and protection, the menace of the handgun was increasing. At the beginning of the sixteenth century the weapon was still clumsy and largely ineffectual, but its possibilities were to be seen by the shrewd observer. It is curious that the new century was to see the most gorgeous works the armourer had ever produced, equipments

most skilfully designed and beautifully embellished, and yet generally there was to be a marked decline in regard for armour.

The craftsman of the early sixteenth century produced some remarkable work, though the day of the armourer was waning. For many more years he was to create armours of great complexity and beauty, but the essential of functional design began to give way to the merely decorative. It has been wisely said that the armourer's craft was governed by five rules: the armour should be suitable for its purpose: convenient in use: its construction should take into account the nature of the material: it should be sound: decoration should be a secondary feature. These points were well observed by Greek and Roman armourers.

In plate armour construction, a great deal depended upon the skilful and accurate fitting of the pieces to the wearer. If all the moving parts, in particular, were carefully measured for an exact fit, there was comparatively little discomfort except as regards weight. Even this could be eased a great deal by careful distribution, so that a 70 lb. armour did not unduly drag upon the wearer.

It was once believed that in the early sixteenth century a fully-armoured man had to be hoisted into the saddle with block and tackle, but there is no truth at all in this. We should guard against the other extreme – stories of the young Henry VIII of England leaping fully armed from the ground into the saddle – but certainly a trained man could carry out normal activities without being greatly inconvenienced by his armour.

Most of the finest armour still in existence dates from the sixteenth century. One reason for this is that often [redacted] equipment of the previous century was refashioned to meet the standards of the time. Another reason is that three wealthy sovereigns were keenly interested in decorative armour, and

they made collections that have survived. These three monarchs were Henry VIII of England (1491–1547), Francis I of France (1494–1547), and Maximilian I of the Holy Roman Empire (1459–1519).

It has become usual to describe as *Maximilian* a style of armour that was frequently seen in the early sixteenth century. This was of Gothic form, with the pieces finely ribbed, like the ridging of a sea-shell. Such work combined strength with relative lightness, as well as being of pleasing appearance.

Another common feature of the armour of this period was to represent eccentric features of civilian dress. Puffs and slashes were repeated in steel, the surface being etched and gilded. Occasionally visors were made up in the likeness of animals or gargoyles, as weird masks. In this way the armourer began to gloss over the true function of his work, by devoting

GERMAN FLUTED ARMOUR
c.1520: TYPE CALLED "MAXIMILIAN"

too much thought to the degree of decoration, to blueing, etching, and damascening with gold. Obviously no one would buy such costly work to spoil it on active service, so this armour was merely a toy.

In spite of the ominous development of threats to the armoured horseman – increasing gun power and tactical efficiency in the employment of firearms – Henry VIII of England indulged his taste for armour by setting up a workshop at Greenwich in 1515. His contemporary Maximilian I had founded a royal armoury at Innsbruck, Austria, in 1504, and Henry seems to have thought more of European craftsmen than his own. He engaged a number of Dutch and German armourers for his new workshop, who were apparently employed only on fine personal armour for the king. They produced some magnificent equipments, and the workshop became well known for its succession of skilled craftsmen. Products from Greenwich have been described as the finest armour that was made anywhere in the sixteenth century. Occasionally Henry permitted nobles to have armour made at the Greenwich workshop, at a tremendous price.

As if in a dying convulsion, the declining years of the complete-armour period brought an increase in the production of armour for infantry and light cavalry. This was low-quality work known as *munition* armour. From about 1500 the rank and file of the infantry were fitted out with a form of half-armour, i.e., equipment that did not fully guard the legs. The assemblage was called a *corselet*, and it comprised breast- and back-plates, collar (formerly called a gorget), light, open helmet, tassets, vambraces, and gauntlets. Sometimes the foot-soldier dispensed with his back-plate and secured the breast-plate with cross-straps. Here we see the first real standing army in England, with a form of standardised equipment.

In fine armour the output was increased by the use of *pieces of exchange*, which were reinforcing pieces or variations

of standard types. By this means it was possible to assemble a number of different equipments from the same basis.

As the sixteenth century advanced, there was a growing tendency to reduce the amount of armour worn in action. However, the large number of complete equipments still in existence show that full armour was frequently used during the first half of the century. We have remarked that the craftsman tended to copy in steel the vagaries of civil dress. One feature thus displayed was the deep *bases* or skirts of the doublet during the reign of Henry VIII. These bases, which reached the knee, were repeated in armour as the *tonlet*, the rigid imitation pleats of which had to be cut away fore and aft for riding. A change took place, too, in the design of the sabatons. When civilian shoes became grotesquely broad-toed, armourers imitated the style.

This was indeed a confused and unreal period in the long

TONLET ARMOUR, c.1511.

story of personal armour. The early sixteenth century craftsman, surpassing all before him in technical skill and adaptation of materials, was yet serving a shadow. It is recorded that the celebrated Kellerman of Augsburg was once paid fourteen thousand dollars for a single armour.

In the best work, free use was made of sliding plates great and small, so that mail could be dispensed with, but no part of the body was unprotected. Some armours still had mail to cover the opening between the taces, but Continental armourers made an accessory known as a *brayette*, like the codpiece in civilian dress, to replace the mail. The latter material was still being made during the early seventeenth century, chiefly for secret defences worn under the coat.

By the early sixteenth century the armourer's workshop was to some extent mechanised. He employed water-power to blow his forges and to drive large polishing-wheels for finishing the work. No doubt, to please the eye of a wealthy patron, craftsmen were guilty of regarding the decoration before the practical value of the pieces in hand. They probably had their own way in many cases, but now and then we can imagine a revolt on the part of the client. For instance, Maximilian I was a patron of the great Austrian armourer, Conrad Seusenhofer, and they appear to have disagreed on at least occasion. The Emperor is recorded as having withered the craftsman thus: "You shall arm me according as *I* wish, for it is I and not you who have to take part in the tournament."

That gallant relic of a bygone age still lingered – "love of ladies, splintering of lances" – and most elaborate jousting-armour was still devised to lock the combatants in their towers of steel. All the panoply and gorgeous display, the fanfares and the loud-voiced heralds, the thundering hoofs and the stirring clash of meeting steel – all were part of a dying age. Over the battlefield the crash and billowing smoke of arquebuse and cannon heralded the doom of the armoured horse-

man. Long before, armour of stone had crumbled before the growing might of the battering siege gun. Now "villainous saltpetre" was to compel the steel-clad man either to bear greater weights, or to emerge from his metal shell and face the shot.

The Swordsmen

The decline of personal armour may have brought about the occasional appearance of a strange defensive weapon. This was the *sword-breaker*, a short, broad blade with a row of deeply-incised teeth on its upper edge. An adversary's sword was caught in one of these incisions, held by the spring there, and broken with a quick twist. Though noticeable only at this time, the idea was even then of great antiquity. A device for the same purpose was used by the Egyptians of the age of conquest (*c.* 1500 B.C.).

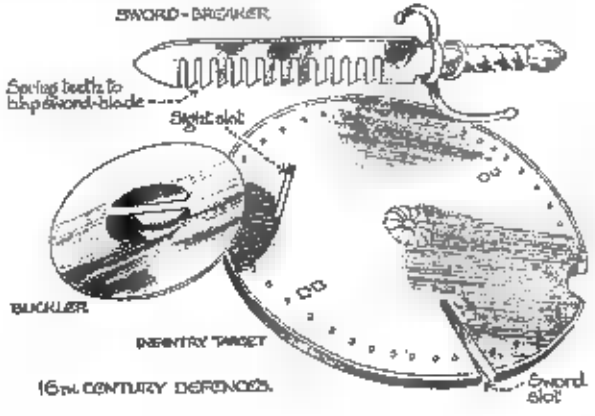
This period of transition saw the beginnings of great changes in the sword, that symbolic weapon of the soldier for thirty centuries. During the Middle Ages, the mail glove or the plated gauntlet had been an important part of the soldiers' defence. The cross-guard of his sword gave little protection to his sword-hand, so that hand had to be guarded.

When, for various reasons, the use of armour began to decline, and metalled gauntlets fell out of use, another form of hand-guard was required. At first, this appeared as a curved bar passing from the quillons to the pommel, as a protection for the knuckles, hence the name *knuckle-bow*.

A further attachment to the hand-guard took the form of additional quillons, curving towards the point. The idea was

that an attacking sword, sliding along the defending blade, would be engaged in the quillons and kept off the sword-hand. To this end there was added the *pas d'ane*, a ring guard extending a short distance down the blade. (See illustration, p. 89.)

Early in the sixteenth century there was developed a short, stout sword that was employed in naval establishments for three centuries afterwards. It was based on the mediaeval French hunting-sword (*couteau-de-chasse*), and it became known in England by the corrupted name of *curtle-axe*.



Shakespeare has Rosalind, in *As You Like It*, speak of "a gallant curtle-axe upon my thigh". A further corruption of the name styled this sturdy weapon the *coutelace*, and finally it became the *cutlass*.

In general, the sword of the early sixteenth century was much less clumsy than the mediaeval types. The developed hand-guard had led to a narrower, lighter blade, though English swordplay was still by the edge.

At this time, a swordsman usually carried a small round *buckler*, about a foot in diameter, one of the last surviving types of shield. This defence was of ancient origin, and small

examples can be seen in many early mediaeval pictures. Unlike the true shield, which was always looped on the arm or shoulder, the buckler was often held at arm's length.

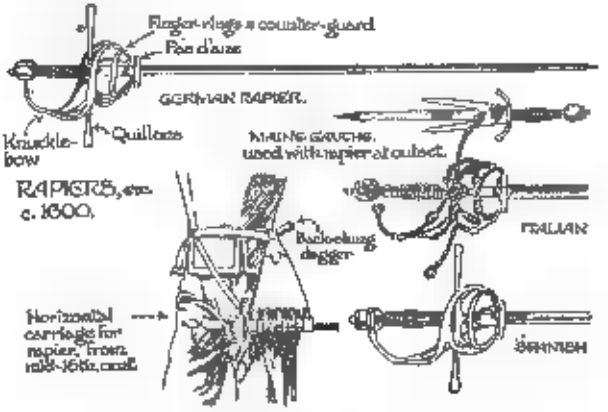
Usually, the buckler was hung at the belt, on the left side, so that if occasion arose the sword could be drawn with the right hand, and the left transferred from the sheath to the buckler, in a few seconds. When the swordsman walked, the buckler swung against his scabbard with a "swash" sound that could be exaggerated at will. For this reason, an overbearing, quarrelsome fellow was termed a "swashbuckler", a name that long outlived the buckler.

Variations of this light defence included the attachment of a steel spike, a sword-breaker, or a steel gauntlet carrying a short sword. Some use was made of an oval target of black iron, intended for foot-soldiers. It was about two feet long, with a sight-hole, and a slit for the passage of the soldier's sword-blade.

However, it seems that, except for isolated survivals, the shield was not used in leading European countries after the early seventeenth century. One such survival was the round target with a central spike carried by the clansmen in the Jacobite Rebellions.

The decline of the buckler was brought about by progess in swordsmanship. During the second half of the sixteenth century an Englishman of dubious reputation returned home from France. Rowland Yorke brought with him a revolutionary practice – the use of the point. This system seems to have originated in Italy, for a book published in 1553 by Camillo Agrippa Milanese contained pictures showing methods of point swordplay. The weapon employed was a relatively light, well-balanced thrusting sword – the *rapier*, which, according to Stowe, was introduced into England in 1571.

However, the rapier was not unknown in England before the date given by Stowe. Henry VIII had a number of these



swords, but it was the manner of use that made the type prominent at the time in question. Previously they had only been used by the edge, and this was still done on occasion, even after the development of the thrust.

The use of the rapier as a point weapon demanded an entirely different technique from that of the edge. With his energy concentrated behind the point, the swordsman needed much more control than when he was simply slashing. Even the hold was different, for the back of the hand was usually downwards in holding the rapier, where it was upwards in using the cutting sword. This new hold led to the addition of *finger rings* before the quillons. In the rings were engaged the first and second fingers, for better control when the hand was turned over.

Some tense situations must have arisen during the transitional period, when the rapier-man encountered the sword and buckler. A stab travels a shorter distance than a blow with the edge, and is therefore more difficult to parry. Nevertheless, if the buckler could contrive to get inside his adversary's guard, the advantage was his. Kingsley's Amyas Leigh, in *Westward Ho!*, related such an experience to his brother Frank.

In the early days of the rapier, it was sometimes used with a small buckler known as ■ *rondelle*. Chiefly, though, it was combined with a dagger hilted with knuckle-bow and quillons, like ■ sword. A number of arms collections show specimens of this dagger, called a *maine gauche*, i.e., for the left hand. The rise of rapier-play coincided with an increase in the deadly practice of duelling. For this the combatants occasionally made use of the *case of rapiers* – a rapier in each hand.

In one respect, the rapier was a power for good on the "field of honour". Before its advent, parties meeting in private quarrels paid little regard to fair play. Extra help was called in, and any unfair advantage was taken. With the old "trial by combat" such a state of affairs could not have existed, for the meeting was held in public, before judges, and under strict rules.

When rapier-play became ■ science, a pattern of conduct was established for duelling. Such meetings were always illegal, and the survivor of a fatal duel was in peril of his life at the hands of the law.

It was soon discovered that a man had to be physically fit to use his rapier to advantage – not only strong, but active. His body had to be as well-tempered as his blade, his mind and eye ■ keen as his point. When ■■■■ and shield had been dispensed with, a high degree of skill was required to provide for attack and defence with weapons alone.

As first practised with rapier and dagger, the technique of swordplay was very different from the fine fencing of later days. There was a good deal of close engagement, where the two blades of each combatant were crossed and engaged to the hilt, bringing the swordsmen closely face to face. When this occurred, the stronger man thrust his adversary away by main force to disengage.

Heavy play like this was possible because the original rapier was much stouter than the more flexible *small-sword* that suc-

ceeded it. The former was really a stiff thrusting sword, with a cutting edge and a well-guarded grip – knuckle-bow, quillons, finger-rings, counter-guard, and *pas d'ane*.

The rapier had a mixed reception in England. It soon became common wear for those who habitually carried arms – gentlemen, military characters, and roystering men-about-town. Some of the last-named carried matters to the extreme by wearing rapiers of excessive length. When such a man picked a quarrel with a citizen wearing a normal sword with a blade of about thirty inches, the blusterer's four-foot sword outreached that of his victim. Stowe recorded that the Queen issued a direction "to place selected grave citizens at every gate to . . . break the rapiers' points of all passengers that exceeded a yard in length of their rapiers . . ."

A note of regret for the new innovation was sounded in a comedy of 1599, where one of the characters lamented:

> "Sword and buckler fights begin to grow out of [illegible] I am sorry for it: I shall never see good manhood again. If it be once gone, this poking fight of rapier and dagger will come up; then a tall man, and a good sword-and-buckler man, will be spitted like a cat or a rabbit."
>
> (*The Two Angry Women of Abingdon*)

This new form of swordplay had brought the dagger into greater prominence, a partner to the rapier. The *maine gauche* was the principal weapon thus employed for formal duels. Some examples had a spring device to extend two additional blades, and a sword-breaker might be fitted to one of them. There were several types of dagger with the normal quillon hilt. For instance, the ordinary dagger (Celtic *dag*, a point) closely resembled the *poniard* (Latin *pungere*, to prick). One form of broad-bladed dagger was the *misericorde*, used, as its name implies, to give the *coup-de-grace* to a defeated opponent. The citizen's weapon was the *baselard*, almost a short

sword, and an Italian member of the deadly company was the needle-like *stiletto*, beloved of the assassin.

It was fitting that the dagger should come to the fore when swordplay became an art, for the dagger was the ancestor of the sword, as shown in our Bronze Age section.

In the ordinary way, a gentleman wearing arms had his rapier (otherwise styled *tuck* or *bilbo*) slung in an elaborate fan-shaped carriage hanging from his belt at the left side. His dagger-sheath was attached to the belt horizontally in the middle of his back, with the hilt to the left. In emergency he grasped his sword-sheath with his left hand in drawing the sword, then reached back to arm his left hand with the dagger. This will show that the dagger was most conveniently used overhand, with the blade upwards. Were the blade downwards, much time and movement would be wasted in raising the arm to strike.

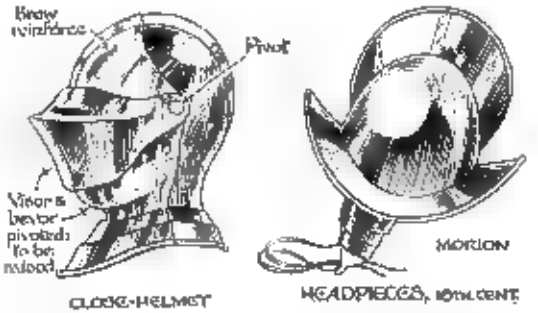
Gun Against Steel

A great deal has been written about the small size of many existing armours, as compared with men of today. This does not mean that modern men are generally bigger than their forbears, for several factors can reduce the original overall size of the equipment. If the body and leg defences are assembled too close to each other on the stand, there may be a loss of several inches in height, and inexpert re-riveting can contract the assembly.

Some of the surviving armours are undoubtedly small, for which there is the possible reason that such equipments were made for youths as their first armour, and were not intended

for service. On the other hand, one armour in the Tower was apparently made for a man nearly seven feet tall. Henry VIII's own armour there shows that he must have been nearly six feet tall, and broad in proportion.

An important and much-worn item of sixteenth century defence was the *close-helmet*, which much resembled the armet. There was one great difference in the face-guard. In the close-helmet this comprised a close bevor and a visor, pivoted on the same pins at the sides. As already noted, the armet had hinged cheek-pieces that fastened under the chin. When putting on the close-helmet, the visor and the bevor



were pivoted upwards over the top of the helmet, and the whole was placed on the head like a bascinet. The bevor and the visor were then pulled down in that order to cover the face opening.

During the first half of the sixteenth century there developed a serious controversy about the use of armour. The menace of the handgun, of little consequence a century before, was now of grave significance. Army commanders were beginning to organise the fire-power of their *arquebusiers*, with the result that armour-wearers had to decide whether to hide themselves in steel of greater weight, or go uncovered and risk the shot.

In some [illegible] a compromise was effected by wearing armour to the knees or waist (three-quarter and half-armour, respectively), and by including a heavy bullet-proof breastplate. Among those troops in knee-length armour were the light cavalry known as *demi-lancers*, of whom the picture gives an example. This equipment dates from about 1550, and the body defences comprise back-and-breast plates and long laminated cuisses reaching from the waist to the knees. Poleyns are attached to the cuisses, and the lower limbs are encased in soft leather boots.

A complete defence is provided for the arms – articulated vambraces, couters, and steel gauntlets. Our subject wears an open, peaked helmet of the type called a *burgonet* (supposedly from their original use by Burgundian troops) and he

DEMI-LANCER, 1550:
Three-quarter-armour

was armed, when mounted, with an eight-foot demi-lance.

The burgonet here mentioned proved immensely popular with foot-soldiers and light horsemen throughout the sixteenth century. It was a light, open helmet derived from the sallet, with a pointed *fall* or peak, often pivoted at the sides. In its early form it had rear-pivoted cheek-pieces. An additional piece called a *bufe* (a form of bevor) was used as a face-guard at times, and some burgonets had barred defences over the face as well. Later forms had extended cheek-pieces that almost entirely covered the face, and towards the end of the century a high ridge or comb was mounted on the crown.

Like the other main headpieces of the sixteenth century, the burgonet appeared in many variations. Newly developed patterns constantly overlapped. In some instances, it was combined with a form of armet, and occasionally it was fitted with an Eastern nasal, a single vertical bar stapled to the brow of the helmet.

As already noted, the sixteenth century was the peak of the armourer's ingenuity, which displayed itself in extraordinary degrees of ornamentation and in unusual designs. Chief among the artists in steel of the later sixteenth century were the Negroli family of Milan, whose work in embossed armour is considered to be unsurpassed. Lucio Piccinino of Milan was another remarkable craftsman in this respect, though his designs have been criticised as being overcrowded.

Civilian fashions were sometimes a source of inspiration to armourers, as with the "peascod-bellied doublet" that gave rise to a cuirass of that form. The "waistcoat" cuirass of 1580 was another example, made like a civilian garment, even to a row of steel imitation buttons down the front. It usually had hinges at the back which permitted the "waistcoat" to open in front, where it had fastenings in stud form.

There were various standard methods of fastening a cuirass. Leather straps with buckles were passed over the shoulders,

and a waistbelt secured to the backplate was buckled in front. Many cuirasses had metal hinged straps and side hasps, and a few were fitted with a hinge and pin-catch. A collar was worn above the cuirass, sometimes with several lames, and the shoulder defences were usually strapped to it.

Prominent among the typical items of sixteenth century equipment was the open headpiece previously called the "kettle-hat". During that century it was known as the *morion*, or in its most elaborate form, *comb-morion*. By about 1550 it had a deep turned-down brim, sharply upswept in a curve to fore-and-aft points, and a high ridge or comb over the crown. The morion figures largely in pictures showing foot-soldiers of the period. As with other headpieces, there were variations in form, but all morions had cheek-pieces of some kind, which were guarded with riveted plates and tied under the chin.

Throughout the latter half of the century, the general decline became more noticeable. As if to accelerate the trend, there was a falling-off of quality, noticeable after the magnificence of earlier years. Design and finish were often lacking, and sometimes one-piece tassets would be marked to simulate lames. This slackening coincided with the growing unpopularity of armour among the rank and file, particularly as regards defences for the limbs. Sir John Smythe, writing in 1590, deplored the tendency to dispense with armour. He remarked that "new fantasied men of warre" scornfully referred to the equipment as "peeces of yron".

As before, it was the handgun that had caused this division of opinion. With the introduction of the musket from Spain (*c.* 1570), the use of good English powder, and an increased rate of fire through training, the handgun was reforming military tactics. It was necessary to test pieces of armour by actual gunfire, and these were then graded as pistol proof,

musket proof, etc. Armour that was not so proved might be pierced by a shot, a piece of plate could be carried into the wound, and the wearer could bleed to death before his armour could be removed.

Though the general quality of the metal was high, it was usual to increase the thickness of the breastplate and head-piece, in particular, which made them heavier. This evidently caused grumbling and rebellion among fighting men. Sir Richard Hawkins prepared for his voyage to the South Seas in 1593 by laying in a stock of proof armour and light corse-lets. His men utterly refused to wear the defences, "but esteemed a pott of wine a better defence than an armour of proofe."

The Battle-car

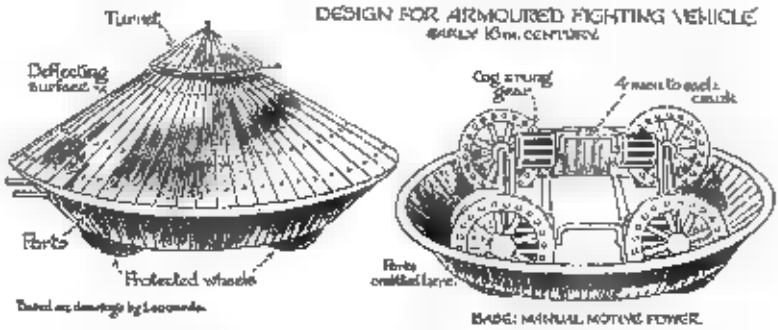
Early in that century of change, when gun and armour had begun their long struggle for supremacy, a curious temporary revival took place. At intervals during the previous two thou-sand years or so, attempts had been made to devise a pro-tected war-engine. Long before the birth of Christ, the Assyrians had employed their armoured battering-ram; the Romans had worked upon similar ideas, and assault towers and covered rams had been in use during the Middle Ages.

It was fitting that the mightiest brain of the new era should have designed a machine with the attributes of the modern armoured fighting vehicle – mechanical drive, protected sides, and fire power. In 1500, Leonardo, that stupendous artist-engineer-scientist, designed a four-wheeled vehicle shaped like a limpet shell. His drawings, now in the British Museum,

show that the outer surface was designed to deflect shot. A number of gun-ports were provided under the outer rim, and under the edge of an upper cap.

Eight men propelled the machine by means of cranks working a cog-and-rung system. Leonardo wrote his advice ▬ tactics: "This is good to break up the ranks of the enemy, but it must be followed up" – a basic principle still applicable to armoured fighting vehicles.

Some efforts were made to develop the idea, for a number of sixteenth-century pictures show battle-cars. Even in far-off Mexico, the beleaguered Cortez, hemmed in by ■ horde of



Aztecs in the centre of Mexico City, tried to reach safety in this way. His men built a stout covered car drawn by horses, but when the vehicle emerged on the street it was subjected to such a thunderous attack with heavy stones from the flat roof-tops that the car had to be abandoned.

German pictures give ■ fair idea of the general form of these early protected war-vehicles. One engraving of *c.* 1520, by Ludwig von Eyb, shows a tilt-waggon armed with small cannon. It was driven before horses harnessed to ■ rear pole, so that by drawing on the traces they propelled the car in front of them.

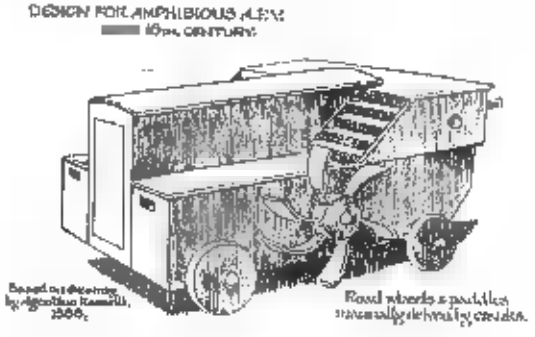
This was the general form of the sixteenth century combat

car, which seems ■ have been developed to a great extent in Europe. There do not appear to have been any English vehicles of this type ■ use until the latter part of Henry VIII's reign, though in his Scottish campaign of 1523, the latter fielded six cannon cars. These armour-plated, two-gun ■■■ were each manned by eight men, and were propelled into action by barded horses harnessed at the rear.

When the English king laid siege to Boulogne (1543) a number of gun-carts and armoured vehicles were named in the Royal Artillery Lists of that date. One type in particular was apparently called the *shrimp* – a small armoured barrow with two light guns pointing forward through a tapered shield, and ■ cluster of curved blades in front.

Vegetius, in *De Re Militari*, edition of 1530, showed a battle-car carrying cannon and hand-gunners, evidently propelled by a walking crew inside. A similar but much larger machine, presumably with the same motive power, is shown in an engraving of 1558, by Holtzschuher. Thirty years later the first amphibious fighting vehicle was designed. Agostino Ramelli (1531–1600) brought out a large illustrated book on various aspects of engineering (*Le Divers et Artificiosi Machine*, Paris, 1588).

Ramelli was chief engineer to Henry IV of France and to Giacomo de Medici, but neither of these patrons seem to have



taken up his idea. The Ramelli amphibian was [redacted] covered wooden car carrying up to six arquebusiers. It had four wheels, and on each side was a paddle-wheel with six curved blades. Inside the machine, man-powered cranks turned the road-wheels or the paddles, as required.

Arms and [redacted] East

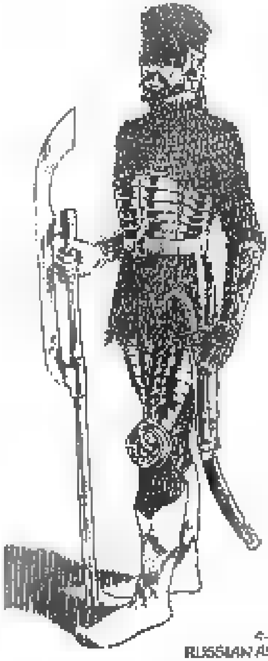
Before going further with the Western story, it would be well to see what had been done among the nations of the East.

One very noticeable point was that the armour of all Near and Middle Eastern countries consisted chiefly of mail, with riveted or solid links. There were none of the complete equipments of plate favoured by Western Europe, and the soldiers of the East retained the conical open helmet with the nasal, usually of the sliding type.

This preference for lighter armour was partly due to the climate, but it reflected as well the mobile tactics of the East. The lightly-armed [redacted] on a fast horse was considered more effective than the human tower of steel.

Eastern influence spread through the Balkans, Hungary, Russia and Poland, as may be [redacted] by the type of armour and weapons used by the mediaeval soldiers of those territories.

In the *Saracenic* armour of Turkey, Persia, India, and adjacent countries, there was a mixture of mail with subsidiary pieces of plate. Turkish armour, in particular, had small plates inserted in the mail, with a few large round plates. The helmets of Turkish soldiers were of a distinctive type, in turban form, pointed or spiked, and frequently adorned with flutings. Five hundred years brought very little



c.1400?
RUSSIAN ARMOUR:
Eastern Influence.

change in the Saracenic type of equipment, for some warriors went out against the British in the Sudan (1898) wearing armour of mediaeval form.

Indian and Persian helmets were conical and often plumed. They had a sliding nasal bar that could be pushed up through the peak when not needed. A mail tippet very like the Western aventail hung from the helmet rim, and was called the *tōp*. Over the shirt of mail were worn breast and back plates in four hinged sections, called "the four mirrors" (*char' aina*), and there were vambraces of plate.

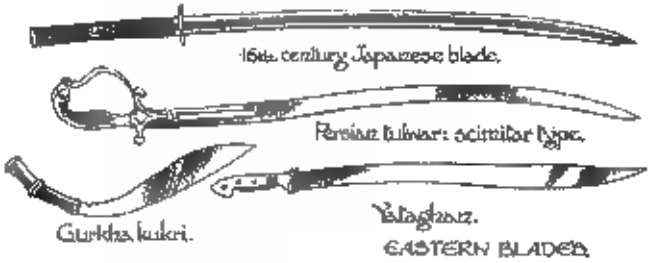
A great deal of the solid work was most beautifully damascened in gold, for ceremonial and display armour seems to have been [redacted] much worn in the East as in the West. There was a lesser defence in brigandine style, a long tunic with small

plates quilted in and covered with velvet. As there were numbers of gilt rivets showing, the brigandine was called "the coat of a thousand nails".

The curved Eastern sword was lighter in weight and took a far finer edge than did the stout swords of the mediaeval West. There is no direct evidence on the origin of the *scimitar*, though one authority derives it from the Persian *shamshir*. It was the basis of the European *sabre*, that passed to the West via the Hungarian cavalryman.

In the curved sword, an oblique, acute-angled section was presented to the target. Only a small part of the edge made the first contact, the rest of the blade being upcurved from the striking section. A straight blade, with a direct transverse section, bore too great a strain on impact to permit the [illegible] of a very fine edge. In a well-made sabre, the grip was set to the blade in such a way [illegible] to make the most of the curvature, just as its Eastern pattern did.

There was great cutting power in the scimitar, but it permitted little defensive action and no point play, [illegible] the small round shield remained as part of the Eastern warriors' equipment until quite recent times. During the Italo-Abyssinian War of 1935, the native chieftains rode into battle with rifles, curved swords, and round shields against the Italian tanks. It is long since the scimitar type of sword was used in the West, but it is still retained in the East, with its small, cramped handhold and its [illegible] in a sweep from the shoulder.



EASTERN BLADES

When Bonaparte made his escape from Egypt in 1799, he and the officers with him brought away a military fashion that spread to their British opponents. This was the Mameluke sword-hilt, a peculiar snake-like form that was favoured by the Turkish warrior-slaves of that name. For a number of years the curved sword with the snake-hilt was worn by high-ranking officers and their staffs.

Throughout the East, there were various lesser weapons in use, such as the *yataghan*, and the *kukri* of the Ghurkas. The fierce Mahrattas of northern India favoured a long, straight, gauntlet-hilted sword. It was an enlargement of the broad-bladed dagger called the *patá*, with a transverse hilt, and a guard for the back of the hand. Another fearsome Indian weapon for close fighting was a three-bladed dagger, its blades radiating to permit stabs to right, left, and forward, in rapid succession.

No other nation of East or West could equal the fanatical regard of the Japanese for the sword. As far back as the eighth century A.D. there was established the tradition of the skilled swordsmith, and the type and form of blade that was unsurpassed through the succeeding centuries. There was only a slight variation in form, from straight in the earliest blades to a smooth curve in the mediaeval era and thenceforward. In the latter shape, there was an almost imperceptible difference between the curves of the single edge, the back, and the face line.

The Japanese sword had a long hilt that followed whatever curve was described by the blade, so it could be used two-handed at need. Its strength, temper, and keenness were the result of the almost affectionate care lavished by the crafts-[redacted] upon his material. Soft iron formed the core of the blade, which was forged by the welding of numbers of tiny laminations. After case-hardening the blade, the edge was separately tempered; it took a razor edge that was supported by the toughness and spring of the backing metal.

This is a broad outline of a process which, in actual fact,

was tremendously long and intricate, as was the means of gaining the remarkable mirror-like polish for which Japanese blades were noted. To the connoisseur, the wavy outline of the tempered area along the edge, and the graining of the blade, shows to what period and what school of craftsmen a particular blade belonged.

After the Japanese civil wars of the twelfth century, the *Samurai* class of professional swordsmen came into being. The magnificent sword was complementary to these men of supreme skill, and they allied to their swordsmanship a high degree of physical culture, *jiu-jitsu, yawara,* etc. There were several different styles of Japanese swordplay, and when an enthusiast had mastered one style, he set himself to become reasonably proficient in the others. Such a [illegible] would tour the country to challenge local swordsmen, and to learn from his conqueror if he met defeat. The privilege of wearing a sword was coveted and jealously guarded, though the manner of wearing weapons must have caused the swordsman's neighbours some inconvenience. Two swords at least were worn at a time. When in civilian dress, the *samurai* had his long sword (*katana*) and its companion (*waki-zashi*), sheathed in lacquered wooden scabbards, edge uppermost in his girdle, and fastened with cords of plaited silk. In the scabbard of *waki-zashi* were carried a traditional small knife (*kodzuka*) and the skewer-like *kogai*.

If the swordsman was going into battle, he had the long war-sword (*tachi*) slung at his left side, with a dagger (*tanto*) in his girdle. It was with *tanto* that the Japanese committed suicide by ceremonial disembowelling (*hara-kiri*) in defeat or disgrace.

Military weapons were not as decorative as the civilian types, for it was on the latter that the artists in metal exerted their utmost skill. Japanese men were forbidden to wear jewellery, so any form of personal display was confined to the furniture of the sword. From the fifteenth century until the

late nineteenth century highly skilled craftsmen vied with each other in producing ornaments in metal that would adorn and strengthen the sword. Jewellery was not employed, except for special work for the highest Court nobles.

By the end of the fourteenth century, Buddhism exerted a powerful influence upon Japanese artistic thought, especially as regards metal-working, and the whole pursuit of sword-decoration gained a great uplift. Many of the embellishments were carried out in a very soft and pure iron, with good effect. The guard was relatively small and thin, so much of the work was put on the grip, blade, and scabbard.

Just as the Japanese sword was a type unto itself, so was their particular form of armour. Its complex structure of overlapping metal strips was designed to resist the formidable cutting power of a two-hand stroke. In appearance, the surviving examples are completely grotesque, with their plates composed of tightly-lacing overlapping segments in shapeless array.

Early equipments found in Japanese dolmen burials show that before the fifth century the basis of the defence was a tunic and skirt of leather. Metal plates were laced upon the tunic, which was covered by a fitting cuirass of riveted plates. After the introduction of the horse into Japan from the mainland, between the fifth and seventh centuries, horseback archery was practised in war. This did not permit the use of a shield, as both hands were needed for the bow, so an armour composed entirely of laced overlapping plates was introduced. It became the standard type of equipment, with a few variations to suit individual ideas.

High-ranking officers of the twelfth century wore the "great harness" (*oyoroi*). It included a helmet like a sallet with a tall, antler-like crest, large plates depending from the shoulders, vambrace-type arm guards, and perhaps greaves. Stretched across the back of the helmet was a fine silk veiling called the *horo*, the purpose of which was to deflect arrows.

JAPANESE ŌYOROI ("GREAT HARNESS"), 17th cent. Grotesque iron mask.

Armour for the rank and file comprised only a cuirass and tassets, called collectively *hara-maki*, "wrapping the belly". However, with the decline of horseback fighting in the fourteenth century, helmets and shoulder-pieces were added to the *hara-maki*. At the same time the *oyoroi* was elaborated by adding an armoured apron over the thighs, and a grotesque iron mask covered the face. During the continuous civil wars of the sixteenth century, some foreign ideas were adopted. Solid plate cuirasses appeared, with brimmed helmets rather like a cabacete.

As in the western world, the making of armour declined in the later sixteenth century. Craftsmen began to study ornament rather than utility, so that when peace was established the armourers turned to highly ornamental work instead of bullet-proof defences.

When American influence was exerted on Japan, in the mid-nineteenth century, the old practices died out. By that time armour was made largely of tough cowhide, and it was worn for the last time in the civil disturbances of 1868. Nine years later the wearing of swords was forbidden, and the only blades forged from then until the Second World War were for ceremonial swords.

Age Warfare

We left the Western nations at the close of the sixteenth century, when the decline of armour was very noticeable, and the edge of the sword was less important than the point.

Prominent among the swordmakers of this period were the craftsmen of Solingen, in Rhenish Prussia, of Milan, and of Toledo. The two last-named cities were famous for fine rapiers from about 1560, though the factories of modern Toledo date only from the eighteenth century.

Solingen has been a great centre for steel blades of all kinds since the early Middle Ages. According to tradition, the industry was founded during the Crusades by swordsmiths from Damascus. Their trade-marks were the running wolf, borrowed from the sword-makers of Passau, in Bavaria, and the orb and cross. Famous names in Solingen during the early seventeenth century were those of Johanne Tesche and Clemens Horne, while some Solingen families such as that of Johann Kindt or Kennet, brought their skill to England to settle in the Home Counties. Another name of great distinction was that of Andrea Ferrara, of northern Italy.

FENCING: TARGET AREAS

At the beginning of the seventeenth century, Italian and Spanish fencing masters were establishing schools throughout England. Training was formal at the outset. The master had the floor of the saloon marked out with a diagram – a square containing a circle intersected by chords, wherein the pupil's moves were directed.

It was not long before formal instruction had evolved a system of directions for given attacks and parries, and the upper part of the body was classified in named areas. The hand delivering the thrust or making the parry might have the back upwards (pronation) or downwards (supination).

Target divisions, as shown in the picture, were broadly arranged as high and low lines, and subdivisions were used to classify the thrust or parry. If a thrust was made at *sixte* (the upper right breast) the defender might parry with his hand in supination. This was classed as a parry of sixte, but if the hand was in pronation when parrying, it would be a parry of *tierce* (the lower right breast). Each parry was classed according to the part of the target area to which the fingers of the defender's sword-hand were pointing.

This brief glimpse of set rules may give a false impression of rigidity, far different from the dashing swordplay of [redacted] heroes. As with any art, the skilled use of the sword depended very much upon initial discipline and trained co-ordination of

brain, eye, and hand. Those early swordmasters drilled into their pupils the fact that a single movement of the blade could mean the difference between life and death in a real combat. Only hard training produced that certainty of movement which marked the skilled man. A favourite feat in period films is the disarming of an opponent by force; the point is engaged in his guard, and the blade is wrenched from his hand. This was possible, but every good swordmaster frowned upon such heavy play. It was considered that skilful swordsmanship should defeat the adversary with the blade in his hand. The essence of skill with the rapier was lightness of touch.

Though there were sound reasons for discarding armour, its decline extended well into the seventeenth century. James I of England (1603–1625) is reputed to have said that "armour is an excellent invention; not only does it prevent a man from being hurt, but it prevents him from hurting others."

This was not strictly accurate, for the firearms of the day were making things uncomfortable for the armoured man, and in spite of the die-hards, the decline went on. A great deal of armour was being made, but relatively few men appeared fully accoutred on the battlefield. Many of the equipments were either highly-decorated products for show only, or pieces specially designed to be hung over memorials in churches.

Another noticeable difference in warfare was the disappearance of most pole weapons. When army organisation was tightened up during the sixteenth century, only the halberd and the long pike remained. Francis I of France made the first practical effort to knit the pikeman into combination with the hand-gunner. In 1534 he raised seven "legions", each of six thousand men, like the Roman unit. Pikemen made up the greater part of the force, but squads of arquebusiers were interspersed to give supporting fire, and a number of halberdiers were provided for the *mêlée* at close quarters.

Only two years later there appeared the Spanish *tercio* of

three thousand men, wherein handguns and pikes were successfully combined. The unit comprised ten or twelve companies, with equal numbers of pikes and arquebuses. Increased fire-power and flexibility rendered the *tercio* far superior to the French legion. Arquebusiers carried swords and daggers, and in later years the gun-rest was armed with a long blade known as a *swine's feather* (Sweyn's feather) supposedly implying Swedish origin.

These continental changes were soon reflected in England. When Henry VIII reviewed the London trained bands at Mile End in 1539, handguns, bows, pikes, and bills were all paraded together. This is the first recorded instance of English troops being drilled with arquebuses and pikes in the same unit.

As the sixteenth century unfolded its years, the pikemen's position was assailed by progress. No longer could they be reasonably sure of keeping unbroken their bristling hedge of steel points. Improved guns and gunnery brought hurtling round-shot to plough long lanes in the ranks of pikes. Their classical advancing formation with charged pikes was rendered hazardous by an increased volume of gunfire. Even in Elizabeth I's reign the pikeman was becoming rather a forlorn figure, gallantly sloping the archaic weapon towards the distant enemy lines half-hidden in smoke. Musketeers could play upon the ranks, breaking them up piecemeal. Next there burst upon them the charge of pistol-firing horsemen, who wheeled away out of reach to reload.

> "The stubborn spearmen still made good
> The dark impenetrable wood:
> Each stepping where his comrade stood
> The instant that he fell,"

but the shades were closing in on the foot-soldier with only steel in his hands.

It was an example of older ideas reluctantly giving way

before new tactics, another phase in the unending struggle between attack and defence – missile and blade pitted against protective covering. As he stood doggedly menacing his foes with the steel, our pikeman symbolized a passing age. His elaborate defences, the long-shafted weapon, were to become futile in the century newly opening before him and his mounted comrades.

Among the heavy and medium cavalry, three-quarter armour was still in use in 1600, with long boots instead of greaves. The first-named unit wore close-helmets and the latter burgonets. It is an interesting point that when plate-armour was adopted in the early Middle Ages, the horseman's

PIKEMAN'S EQUIPMENT, c.1610

legs were equipped first with solid defences. In the days of decline, the legs were first to be disarmed.

At this time (1600) fighting men displayed gay little scallops of coloured fabric or leather around the edges of the pauldrons and some other pieces. These scallops were the extended edges of the linings, and were known as *pickadils*.

Light cavalry, including horsemen with firearms, wore the burgonet, with a cuirass, collar and pauldrons. A long steel defence called an *elbow-gauntlet* was worn on the left forearm and hand. The pikeman of the heavy infantry was the only well-armoured foot-soldier. He had the corselet equipment of breast-and-back, collar, and pauldrons, with vambraces. There were large tassets, often hinged direct to the breastplate, and the whole defence was topped with a morion.

Other footmen, such as musketeers and light infantry skirmishers, wore jacks or *buff-coats*, with morions. Buff-coats were stout leather garments with deep skirts, supposed to have been originally made of buffalo hide. After about 1620, these coats replaced the arming doublet, and the foot-soldier shed still more of his armour. Only body-armour, tassets, and pot-helmet (a variation of the morion) remained to the pikeman, and the musketeer paraded in buff-coat and broad hat.

Such was the equipment of the troops engaged in the Thirty Years' War (1618–1648) when the Protestant powers of Europe pitted themselves against the military strength of the Catholic nations. While this deadly struggle was going on, Britain became a divided nation through the quarrels between Charles I and his subjects. At last, in 1642, the gathering storm burst, and the King was forced to resort to arms.

Promptly to the aid of the Royalist cause came the dashing and soldierly Prince Rupert, the King's nephew, from a sojourn in Holland. Rupert's tactics were yet another nail in the coffin of the armoured pikeman. Previously the cavalry had advanced on the embattled ranks of the enemy foot, fired

their pistols, and wheeled away to reload. This was basically unsound in principle, as the retiring horsemen were forced to cross the front of an unbroken enemy.

Prince Rupert introduced the new method of his native Germany – his troopers advanced at full gallop, the front rank fired, and the whole detachment charged home with the sword. These tactics of bullet followed by steel, and the Prince's personal recklessness, almost gained the day for the King at Marston Moor, Yorkshire, in 1644. Thenceforward, this became the pattern of cavalry action.

A reform ■ sweeping meant a further stage in the decline of armour. The horseman was too much impeded in the new

LIGHT HORSEMAN'S DEFENCES, c.1645.
Pistol-proof breastplate and pot.

activity if he wore the old three-quarter equipment. This began to go out of use early in the Civil War. Some Royalist mounted men used only a back-and-breast over a buff-coat, with a pot. Others dispensed with the cuirass, and wore just a deep steel collar over a buff-coat.

There was a curious development among the cavalry at this time. Apparently it was difficult to recruit men who were likely to become proficient lancers, so the lance went out of use, and the heavy cavalry were named *cuirassiers* after 1620. However, as before mentioned, three-quarter armour was judged too cumbersome, so it was discarded before the middle of the century – a big step towards the end of an epoch.

Many Royalists seem to have dispensed with the steel cavalry helmet, though some forms of reinforced hat were in use. An iron war-hat with a nasal, that had belonged to Charles I, was held for many years in Warwick Castle, and small steel caps for fitting inside hats are preserved in many European museums.

Cromwell's "New Model Army" of 1645 retained for cavalry the steel pot, rather like the old-type burgonet, that had been introduced about 1630. It had a peak carrying a triple-barred face-guard, and the neck was defended by a "lobster-tail" of laminations. In cheap pots the latter were simulated by ribs on the neck-guard. Our picture shows a light horseman, chosen as an example because Cromwell was once a colonel of light horse.

The trooper appears in buff-coat, cuirass, and guarded helmet, with an elbow-gauntlet on his left arm. It was with these hard-trained, rigidly disciplined troops, aptly styled *Ironsides*, that Cromwell finally ground the Royal forces into subjection. He employed the principle of the steady, remorseless advance instead of the headlong gallop of Rupert's cavalry.

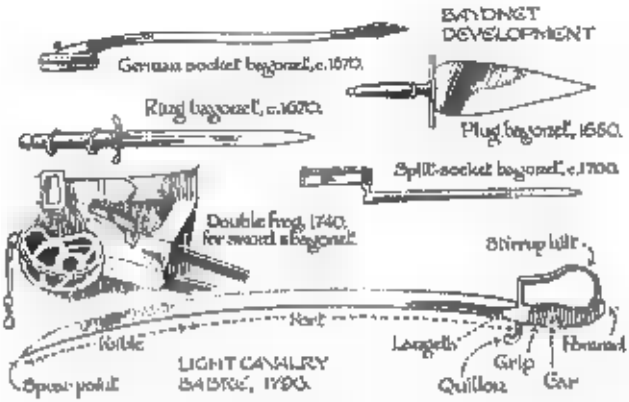
Bayonet and Sword

After the Civil War, the pikeman was outdated, for his clumsy eighteen-foot pike was useless in any but the most favourable conditions. His earlier function as a defence for the musketeer was no longer necessary. The latter was able to reload in little more than a minute, so he had no need to seek cover for the purpose. Obviously the time was at hand when the musketeer could carry both offensive and defensive arms effectively.

This situation was foreseen by military writers before the war. Gervase Markham's *Souldier's Accidence* (1625) remarks on the issue of musket-rests having "iron pikes on the nether end" – another form of the "swine's feather" already mentioned. Two years later, pikemen of the London Company of Artillery were issued with a type of musketoon, in an attempt to combine missile and hand weapon as a one-man unit.

A more significant move, though unpractical, was William Barriffe's idea (*Militarie Discipline*, 1639) "to make the muskettier as well defensive as offensive. Some by unscrewing the heads of their rests and then screwing the rests into the muzzle of the muskett." Ineffectual as it was, this was one of a number of attempts to provide a form of *bayonet*, so that musket and bayonet could provide a complete offensive-defensive unit for one man. This was the sequel to the re-equipping of the London Company.

There is a great controversy over the origin of the bayonet. A popular belief is that the weapon was invented and made by M. Puysegur at Bayonne, in France, about 1640. This story was refuted by M. Demmin, the French nineteenth-century historian, who claimed that the bayonet was known in



France and Germany about 1570. M. Demmin cited examples of sixteenth-century bayonets (probably hunting weapons) in the museums of Hanover and Augsburg.

However, the heavy matchlock musket was not a suitable mount for the bayonet, and the latter was little used until the mid-seventeenth century, when the flintlock musket was becoming common.

At first, the *plug bayonet*, ■ it is usually called by students, was simply jammed into the muzzle. There was considerable taper on the hilt, to allow for variation in the bore of the muskets, but this often caused trouble. If it were thrust in too hard, the bayonet might be difficult to remove for loading and firing, and if fixed too loosely it might shake out or remain in the adversary's body.

A number of the early bayonets had very broad blades, and most blades were about a foot long. The British Army's first issue bayonets were bought in France, though the drill-books of that time referred to them as daggers. In the regulation waistbelt there were frogs for the sword and bayonet, the latter being carried almost centrally in front.

These plug bayonets had a further disadvantage – they displayed that the musket was not in condition to be fired, so it

was desirable to fix the bayonet clear of the muzzle. There is a popular story that General Hugh MacKay invented the *ring bayonet* after the battle of Killiecrankie (1689), when he was defeated by the rebellious Scottish Catholics under Viscount Dundee. In this improved bayonet, two rings were spaced out along the hilt, and the musket-barrel was slipped through them, leaving the muzzle clear.

General MacKay's claim is discounted by De Puysegur's *Art de la Guerre*, which contains a reference to ring-bayonets seen by the author in 1678. It will be noticed that, though Bayonne was *not* the place of their origin, bayonets were indeed named after this French town.

Like its precursor, the ring-bayonet was not a complete success, through the variable sizes of musket-barrels. The latter were made by different contractors, and the bore might vary by as much ■ '1 in., ■ the fit of the bayonet ■■ still a matter of chance.

There was the same difficulty when the two rings developed into a socket. In 1688 Louis XIV ordered a number of experimental socket bayonets, but during a trial ■■■ of them fell off, and others were damaged on firing with fixed bayonets. By 1700 the *split-socket* pattern had been evolved, giving a close spring fit on any size of barrel.

Two years later, the British authorities finally put aside the antiquated pike. All foot-soldiers then combined the functions of musketeer and pikeman, by virtue of musket and bayonet. A double frog was later devised, to allow the infantryman's sword and bayonet to be carried together at the left hip. Our picture shows the frog as worn by mid-eighteenth century infantry.

Meanwhile, the final stages in the decay of body-armour were taking place. Until the last years of the seventeenth century, cavalrymen clung to their breast-and-back plates, polished or black-painted. In 1698, these defences were called in, though the Duke of Marlborough reissued some of them in

1707. He ordered the cavalry to wear breastplates only, and to encourage them to charge home with the sword, he allowed them no pistol ammunition.

These horsemen of Marlborough's were armed with a stiff, pointed cutting sword, like a heavy rapier. In charging, the point was used, but the rider cut with the edge when at close quarters. This was the true function of the military sword, to cut and thrust as well, but for two hundred years controversy raged over the dual-purpose sword. The best thrusting sword should have a down-curved grip, to allow the hand and thumb to be correctly positioned, but the best grip for cutting is perfectly straight. No sword yet evolved has combined the two functions perfectly.

In spite of the general use of the point in the eighteenth century, much attention was paid to the *backsword* (i.e., single-edged sword), and as a means of practice the *single-stick* became very popular. The latter was a tapered ash rod about three feet long, with a basketry cup-hilt. It had originated in the sixteenth century, and until about 1650 it was formed like a cudgel with a metal handguard.

At first, hits were limited to the upper part of the body, but by about 1770 the combatants stood close together, with [redacted] foot movement. A high guard was maintained, and though hits could be scored on any part, a *broken* or bleeding head decided the bout. In later times, single-stick play was revived as a school for the cutlass in some naval establishments.

By the beginning of the eighteenth century, the old-pattern rapier was only used as a horseman's sword. For everyday wear there was the *small-sword*, a lighter, shorter weapon with a shell-guard. It was first used in England about 1660, and its modern counterpart, still employed in French duels, is the *épée-de-combat*, with a triangular 35 in. blade, weighing 1½ lb.

Though duelling was always an indictable offence in England, it was quite common during the eighteenth century.

Swordsmanship was still a requirement for a gentleman, and the famous prizefighters of the day, such as Figg, made a sideline of swordsmen's instruction. Many old practices survive in modern fencing with *foils*, light 1 lb. small-swords with a guard-button on the point.

Parries were made *direct*, by deflecting the opposing blade on the same line as the attack, or *circular* (counter) by warding off the attack on the opposite line. Eight parries were learnt by the swordsman, four each in supination and pronation. When on guard, the legs and arms were bent, and the whole body was tensed like a spring.

There were three regulation moves in the attack – the *lunge*, the *marche*, and the *run* (*flêche*). A lunge was a spectacular form of attack, only to be delivered when a clear opening was found. The weight of the body was thrown forward on the bent right leg, with the sword-arm and the other limbs completely straight. An advancing attack, the *marche*, was made by bringing the rear foot up to the other, and the *run* was the further advancing of the rear foot to the front.

Towards the end of the eighteenth century the *riposte* was developed – the parry continued into a return thrust. This was a feature of the instruction of Signior Angelo, who was in London at that time. In addition to regulation moves, the dream of the skilled swordsman was to acquire a secret *botte*, some deadly move peculiar to his own play.

The small-sword was habitually worn by a gentleman when walking or at social functions. A waistbelt under the coat supported the weapon, and the hilt protruded through the top of the pocket, under the large flap. There is a reminder of this practice in the House of Commons, where loops of red braid depend from the Members' coat-pegs. They were originally intended for the Members to hang up their swords, as no weapons were worn in the House, except by the Serjeant-at-Arms.

At the end of the century, when interest in boxing and

wrestling was on the increase, the practice of sword-wearing declined. During this transitional period, a gentleman might sometimes carry a swordstick – a light two-foot blade in a hollow cane, the top of which formed the hilt.

The vexed question of the most effective cavalry sword was still much to the fore when a partial solution was derived from the East. Many British and European mounted troops of the later eighteenth century were issued with a light type of cavalry sword introduced from Hungary, the land of the famous Hussars. The curved blade of the sword betrayed its Eastern origin, though it was known by its German name of *sabel*, soon to become *sabre*. It was destined to become the cavalry sword of the nineteenth century, without, however, settling the case for the use of the edge.

During the Peninsular War (1808–1812) there was a clear demonstration of the advantage of the point in a charge. French cavalrymen were trained in the point, and as a result, their British opponents, who used the edge, suffered more losses in killed than in wounded. The technique of the rigid sword-arm and the determined thrust, delivered from a fast horse at full speed, was not easy to counter. On the other hand, a man had to be highly trained to confine himself to the thrust when engaging a slashing opponent.

Point Weapons Declining

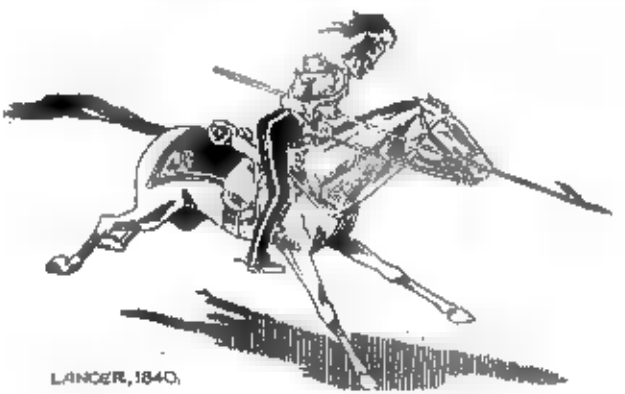
During the twenty-two years of the Napoleonic War (1793–1815, with an uneasy peace in 1802) ample proof was given that armour no longer had a place in battle. Its last phase, in the second half of the eighteenth century, was the decora-

tive gorget, the small crescent worn upon the chest by infantry officers.

The British Army made no significant use of armour in the French war. Household Cavalry units went into action in the cocked hats and full-skirted coats of a former age. It was not until 1821, after the accession of George IV (1820–1830) that the Life Guards and the Horse Guards were issued with cuirasses. Various light and heavy cavalry units had worn helmets of metal or leather during the war, but these head-dresses were more showy than practical.

The eighteenth century had seen the general decline of the lance, that ancient weapon of chivalry. Only in Poland was it still retained, ■ an important cavalry arm. Napoleon made efforts to revive its use, but his Hussars of 1801 made a poor showing through lack of training. However, his experiments drew attention to the possible uses of the lance in open country, and by 1827 the British authorities were testing lances up to sixteen feet long. Finally a nine-foot pattern was adopted, the shaft being of male bamboo or ash.

Throughout the next seventy years or so, the lancer was prominent in the armies of the civilized world. The pursuits of *tent-pegging* – lifting tent-pegs from the ground with the lance-



LANCER, 1840.

point – and, in India, *pig-sticking* (hunting wild pigs with the lance) provided means of practice. However, the final eclipse of the lance was to come, through the factor that had ruled out body-armour and pike – increasing fire-power.

In 1903 the lance was withdrawn from the British Army, but it was reissued in 1909, and with this archaic weapon the British cavalry went into action in 1914. They were balanced by the German Uhlans, with their black-and-white pennons waving on the battlefield of torrential shellfire and storms of machine-gun bullets. Good work was sometimes done with lancers under hand-picked conditions, particularly in the Eastern theatres of war, but their day was finally ended by an Army Order in 1927. The lance survived only as a feature in military displays.

While other arms were being developed, the bayonet was going through further stages of evolution. Though socket bayonets had been devised very soon after the adoption of the weapon, no satisfactory fixing system had been produced by 1840. The regulation nineteenth-century bayonet was of triangular section, narrow and tapering, with [redacted] angled slot in its socket that engaged behind the foresight of the musket. On the rifle, a side lug was engaged, and in both cases the blade was fixed on the right-hand side of the muzzle.

An efficient locking spring was urgently needed, for a daring enemy was able to pull off the bayonets. It is recorded in the Journal of the Royal United Service Institution that this happened to [redacted] of the 22nd Regiment in India, at the battle of Mecanee, 1843. The men were forced to tie on their bayonets for security.

There was one type of locking bayonet extant, or rather, [redacted] short sword with fittings to permit attachment to a rifle. When the infantryman's sword was withdrawn, in the late eighteenth century, [redacted] units were afterwards issued with a *sword-bayonet*. For instance, the Rifle Brigade of 1800 received a

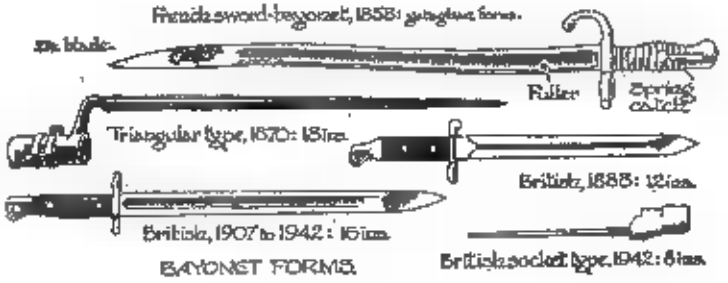
cross-hilted, side-fitting sword-bayonet, with a locking spring. A knuckle-bow was added to the hilt in 1801. This issue led to a difference in arms drill as compared with other units; in the Rifle Brigade the order was: "Fix swords!".

Apparently the French were the first to introduce the sword-bayonet. They adapted the North African *yataghan* for the purpose, whose two-waved form was discernible in the French bayonet.

A great drawback with the sword-bayonet was its relatively heavy weight for shooting when fixed. The regulation triangular bayonet weighed barely 1 lb., but some sword-bayonets, with their solid hilts, weighed nearly 2 lb. It was for this reason that the latter were finally fixed under the muzzle; they were hopelessly unbalanced at the side.

Several issues were made in 1836, 1855, and subsequently. During the later nineteenth century saw-backed sword-bayonets were issued to British troops, chiefly pioneer corps. Incidentally, there was a great outcry in the Press early in the 1914–18 war because some German units had the saw-backed bayonet – "a barbarous weapon". The British Army had been issued with such bayonets for fifty years or more.

In the middle 1880's the old-type triangular bayonet was withdrawn, and the British Army's Lee-Metford rifle of 1888 carried under the muzzle a shortened sword-bayonet, Mark I, with a 12 in. blade.



BAYONET FORMS.

Later, an issue of the short Lee-Enfield rifle, five inches less than previous patterns, called for an increase in bayonet length, so a 16 in. weapon was supplied. This was used right through the First World War, and in the Second War until 1942. At that date experiments were being made with an 8 in. triangular bayonet with a socket fitting like the old pattern. The new bayonet became a general issue, though it was not fully satisfactory, through a tendency to break off. There was no longer an arms drill for fixing bayonets, since the new weapon was not adaptable for the purpose.

In the German army of 1939–45 the bayonet was largely replaced by the machine-carbine. The former weapon was still issued, but its use was little practised. Other European nations continued to train their troops in bayonet fighting – the parries, the quick, short thrust at the throat, and the recovery on guard.

The Ironclad Ships

The pages of early history abound with stories of armoured ships employed by Romans, Greeks, Saxons, etc., but isolated experiments did not signify. Ships with defensive armour were really developed through the exigencies of the siege of Sebastopol in 1854, during the Crimean War. A bombardment by wooden warships of the British and French fleets was countered by shell-fire and red-hot shot, which drove off the attackers with loss. Stone forts manned by determined Russian gunners proved a match for wooden ships.

The French naval authorities acted upon a suggestion that had recently been made in the United States. Five "floating

batteries" were built, each mounting iron armour $4\frac{3}{8}$ in. thick, backed by ■ in. of oak. This system of wooden backing was designed to give the armour plate a slight resilience when struck, the better to absorb the shock. *Tonnante*, 16 guns, was the first of these *ironclads*. She was launched at Brest in March 1855, and, with her sister vessels, *Devastation* and *Lave*, she took part in the reduction of the Russian fort at Kinburn, in the Dnieper estuary, in October 1855.

A special correspondent of the *Times* reported on the French vessels at Kinburn:

> "The balls [from the fort] hopped back off their sides without leaving any impression, save such as a pistol-ball makes on the target of a shooting-gallery. The shot could be heard distinctly striking the sides of the battery with a sharp smack, and then could be seen flying back, splashing the water at various angles according to the direction in which they came, until they dropped exhausted."

There were two interesting features about the *Times* report. It was ■ account of the first ironclad action, and it was rendered by a war correspondent. Never before had a war been reported at first hand by a newspaperman.

When the despatches on the Kinburn attack were at hand, the Admiralty acted so swiftly that within ■ week of the action the British ironclad batteries *Erebus* and *Terror* were on the scene. They were shallow-water vessels, hurriedly built and difficult to handle, but their advent spurred the French to take the lead again. On the stocks at Toulon was a wooden line-of-battle ship which was converted to a frigate and sheathed in wrought iron of $4\frac{1}{4}$ in. thickness. In November, 1859, she was launched ■ *La Gloire*, 5,600 tons, the first ironclad ship – for the earlier batteries were not classed ■ ships. Indeed, they had been scathingly described as armoured barges.

The British reaction to *La Gloire* was rather curious. For

some time there had been a trend towards iron ships, ■ iron gave greater rigidity to the hull, permitting the construction of longer ships and the use of water-tight bulkheads. Subdivision of the hull, a double skin, and both longitudinal and transverse bulkheads were all security ideas that had developed during the previous few years. Before the Crimean War, the Admiralty had not favoured iron warships, ■ being difficult to repair where a shot had pierced the plating. However, the use of armour promised better protection.

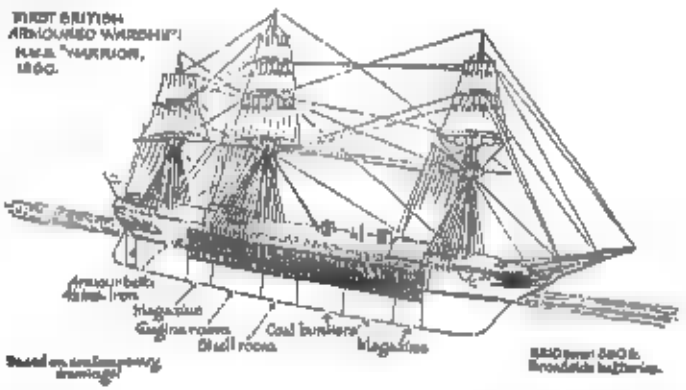
A Cabinet committee had been formed in 1858, under Lord Derby, to look into Naval costs, and to find whether the French had the lead in screw-steamer warships. In their report of January, 1859, the committee did not recommend the building of an armoured vessel; they simply advised the conversion to steam of a number of sailing warships. As the French had nearly completed the conversion of all suitable sailing ships, the committee furnished a table showing the comparative steam-and-sail strength of the respective navies. A final item on the table gave France as building four iron-plated ships; England, none.

This last entry changed the whole situation for the Admiralty. An ironclad ship was laid down a few months after the report, and soon there were sixty-seven wooden steamships building or converting for the Navy, though many were never completed. When the first British ironclad, *Warrior* (9,210 tons, 380 ft.), was launched in December, 1860, the British authorities slowly realised that wooden ships were outdated. This opinion held consequences of international effect – the centuries-old Baltic timber trade dwindled to a mere shadow almost at once, as did the demand for English oak. On the other hand, the expanding iron and steel industry was well able to take over, with increased imports of Swedish iron ore.

Though *Warrior* was classed as ■ ironclad, she was an iron ship, superior to her French fore-runners, which were wooden

ships sheathed in iron. A practical armoured ship was only made possible by the use of steam power, for the weight of metal would have badly impeded a sailing warship.

However, limited bunker space caused sails to be retained for emergency or favourable conditions. ■ *Warrior*'s lines and rigging were those of an extra large frigate of that time. Around the central part of the vessel, from the upper deck to five feet below the water-line, was a belt of wrought-iron armour 4½ in. thick, with a backing of 18 in. of teak. The main deck broadside battery of 36 sixty-eight pounders was enclosed fore and aft by armoured bulkheads.



Inside the wooden backing of the main belt was a lining of ⅜ in. iron, called by the designers *skin-plating*. Its purpose was to arrest splinters from the woodwork and possible bolts driven in from the plating, which would present a danger to the crew in action. The armour had been proved at two hundred yards with a sixty-eight pounder gun, shots from which made only small dents and rebounded. Further shots were fired from a two hundred pounder, without penetration; the shot broke into splinters, and the plate became heated but remained intact.

Warrior's armour represented the second stage in ship protection. Earlier in the nineteenth century, trials had been made in Britain and the U.S.A. with cast-iron plates. It had been seen that cast-iron shot broke up or flattened itself, but that hard plates became shattered by the impact. Wrought iron is softer but tougher and slightly resilient, so it was found to be more resistant to projectiles. The gigantic battle between gun and armour, which had its small beginnings in the story of personal defences, was thus hugely expanded.

Closely following *Warrior* came her sister ship, *Black Prince*, whose defences were arranged in a similar way – armour amidships, but none at bow and stern. This "central citadel" plan had its defects in an otherwise unarmoured ship. In *Achilles*, of 1861, additional armour was extended all around the hull, above and below the water-line. The screw and the steering gear were thus protected, as they had not been in previous ships.

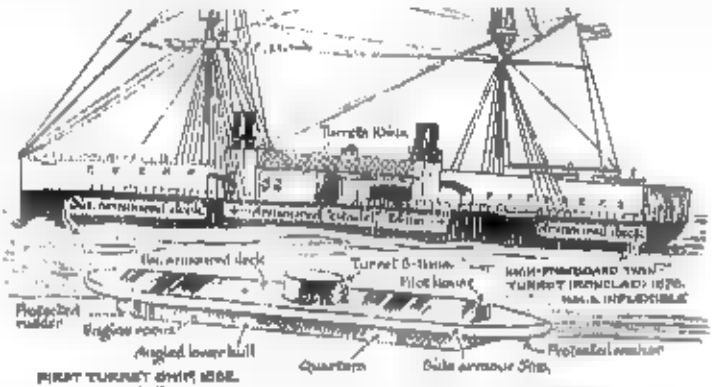
Three five-masted ironclads were then built, *Minotaur*, *Agincourt*, and *Northumberland*, each with a continuous belt of 5½ in. armour. As the designers sought fine lines, the extra weight of armour made greater length necessary, so the three new ships, each displacing 10,690 tons, were 400 ft. long. All these craft were unsatisfactory to the authorities, in that their length made them unhandy in manœuvring.

Meanwhile, history was being made on the other side of the Atlantic, in the naval forces of the contending American states. At the opening stage of the four-year war (1861–65) the Southern (Confederate) forces had partly burned the U.S. Navy steam frigate *Merrimac*. She was lying at the Norfolk Navy Yard, near the mouth of the James River, Virginia, and towards the end of 1861 the Southern authorities decided to convert her into an armoured vessel. Accordingly, she was cut down to within three feet of the water-line. A house-like structure, with sloping sides, was built in oak and pine to a thick-

ness of 20 in., and plated with 4½ in. iron. This defence extended over the screw and rudder.

Merrimac was provided with an iron ram, and with eight heavy guns (chiefly 11 in. calibre) mounted in broadsides. She is often described as being covered with "railroad iron", but the official records of both sides agree that she was plated. Though the vessel was renamed *Virginia*, her old [illegible] stayed with her.

When the Federal (Northern) authorities learned of these activities, they published a request for ironclad designs, with a



REVOLVING TURRET ARMOURED WARSHIPS.

view to immediate work on such a vessel. They accepted the plans of Captain John Ericsson (1803–1889) the distinguished seaman-engineer, and Ericsson's *Monitor* was launched on January 30th, 1862.

Some weeks later, on March 8th, *Merrimac* left her moorings, and, with a number of smaller vessels, steamed into Hampton Roads, at the mouth of the river. There she went into action with a number of wooden frigates and small craft of the Federal Navy – the first ship-to-ship battle fought by an ironclad.

It [illegible] a slaughter. *Merrimac* first raked the *Congress*

frigate, then rammed the *Cumberland* and pounded her with a destructive fire while she was sinking. During the whole of this action, *Cumberland's* repeated broadsides were rebounding like peas from the attacker's iron sides. As *Cumberland* sank, with her topmasts and colours still standing out of the water, *Congress* again became the target. After an hour of battering, the Federal vessel struck her colours, but she blew up later.

Having battered the *Minnesota* frigate until nightfall, *Merrimac* withdrew. Had she remained in the roads, her captain would have seen Nemesis arrive in the broad waterway. Ericsson's *Monitor* came up in darkness, but when the Northerners saw her by daylight, she was not impressive. Lying very low in the water, she looked like a submarine, with her flat deck, and her turret, 9 ft. high and 20 ft. in diameter. In effect, she had a double hull, the sides of the lower hull inclining at a sharp angle towards the flat bottom.

Monitor was heavily armoured. There were 8–11 ins. of metal around the turret, 5 ins. along the water-line, and an armoured deck 1 in. thick. The turret, carrying two 11 in. Dahlgren guns, was revolved by steam, and fed from a trunk below. Though she was manœuvrable, the vessel's speed was low, and she was completely unsuited for the open sea.

On the morning of March 9th, 1862, the two champions steamed into action, to fight the first engagement between armoured ships. The vessels closed to fifty yards, and bombarded each other furiously; the roadstead resounded to the thunderous uproar, and dense smoke rolled over the water. *Monitor* circled like a boxer, testing her huge opponent's sides. Once the latter attempted to ram, but *Monitor* was too skilfully handled, and though *Merrimac* was firing two or three shots for every one she received, neither vessel showed any serious effects for some time. Finally, the circling *Monitor* got home with three shots, which, said an eye-witness, did not rebound

but appeared to cut right into the ship. Shortly afterwards, *Merrimac* steamed off.

This victory for a new design gave a false impression, and for a short time the world's naval powers looked favourably upon the low-freeboard turret ship. However, *Monitor* soon showed her unseaworthiness in anything but a flat calm. She plunged ■ heavily outside harbour that the sea washed over and into her turret, and at last she foundered, though her pumps could throw out two thousand gallons a minute.

Armour of Weight

In spite of the obvious drawbacks, the American authorities continued to build on the lines of the *Monitor*, ■ exampled by the ironclad *Miantonoma*, which ■■ sent on ■ world tour in 1867. She was a twin-turret *monitor*, armed with two 480-pounder guns in armoured turrets, and her freeboard in a calm was under 3 *ft.*

Two plain facts now confronted naval architects. Wooden warships were useless, and the best ironclads were ships built of iron and armour-plated.

In England, the Navy was being reorganised, and a long chain of experiments began to improve the defensive qualities of armour. Increased thickness was the obvious beginning, and wrought-iron plates were sandwiched between wood linings, with a stout iron outer shield. This was a "soft" type of muffling armour, so hard projectiles, such as Palliser's chilled cast-iron products, were used against it. Artillerists based their ideas of penetration on the rule that ■ shot would pierce wrought iron to a depth of one calibre for every 1,000 ft. of

striking velocity. For example, a 6 in. solid shot with a striking velocity of 2,000 ft. per second penetrated two calibres, or 12 ins., of wrought iron.

A great controversy in British naval circles attended the gun-armour contest in the period after the American war of 1861–65. Captain Cowper Coles upheld the armoured turret system with a low freeboard, while the designer Reed (later Sir Edward Reed) voted for the broadside battery, with armour around the battery and the water-line area. Typical of the "compromise" ships was the *Monarch* of 1865, with a freeboard of 14 ft., 7 in. side armour, and two turrets defended by 10 in. and 8 in. armour.

In opposition, Captain Coles built the ill-fated *Captain* in 1869. Her armour varied betwen 3 and 8 ins., she had a great deal of topweight, and, through an error, her freeboard measured only 6 ft. ▮ ins. She capsized in the Bay of Biscay, with the loss of 490 men, including her designer.

The *Captain* tragedy was followed by a change in Admiralty policy, and shortly after the sinking, in 1871, the first unrigged seagoing ironclads appeared. *Devastation*, laid down in 1869, was 285 ft. long and 62¼ ft. beam, displacing 9,060 tons. Her freeboard was only 4 ft. 6 ins., except right forward, but this could not be compared with *Captain*, as in *Devastation* there was no unsteadying topweight of masts and sails. The latter's side armour was 12 ins. thick, except on the after part, where it was 4 ins. thick above the water-line. At that level there was an armoured deck. A redoubt, with armour 10 ins. to 12 ins. thick, enclosed her two turrets, whose thickness ranged from 12 ins. to 14 ins.

During trials and subsequent cruises, the steam-only vessel satisfied the authorities, so in 1876 H.M.S. *Inflexible* came into service. She was a further venture into the unusual, for her beam was exceptionally broad – 75 ft. for ▪ length of 320 ft. There were two reasons for this. Her total weight of

armour scaled 3,155 tons, and her turrets were set in a wide diagonal to permit ahead or astern fire. The redoubt, or *citadel* as it was then called, had 18 in. armour, and the turret armour was 16 ins. thick. *Inflexible*'s 24 in. side armour did not extend beyond the citadel, but a 3 in. armoured deck covered the bow and stern sections. Above the armoured deck, in each of these sections, was a belt of cork and part of the ship's coal supply. In this way the designers hoped to ensure flotation if the ends of the vessel should be holed, while providing maximum strength and fire-power in the citadel.

While these developments were taking place, similar trials of armour were being made as regards fort defence. British coastal forts had vertical walls with wrought-iron outer plates, singly, or sandwiched with wood and concrete – the "soft armour" defence. At the opposite extreme was the system adopted for most European forts after 1868. It was a German scheme (Gruson's, of Magdeburg) and it provided for huge blocks of chilled cast iron, in any form required, which were keyed together without bolts to form the entire defence.

Until about 1875 steel was not favoured for ship or fort armour. It was considered too brittle, and writers of the period compared the softer but tougher wrought iron with steel that tended to shatter after a few hits. Hard armour-plate was judged suitable for coastal forts, where only brief attacks could be delivered by raiding warships.

An example of the leap-frog progress of the gun-armour contest was the fact that while *Inflexible* was completing, Italy was building two vessels, *Dandulo* and *Duilio*, whose turrets were armoured 22 ins. thick. During the trials of their armour, at Spezia, different makers produced iron and steel shields of 22 in. Guns of 10 in. and 17·72 in. calibre were fired against these, and projectiles from the former lodged in the wrought iron and cracked the steel. The big 17·72 missiles easily pierced the iron but were stopped by the steel, though the

latter was broken up in the process. By this means, *Inflexible*'s armour was outgunned before she was in service.

These trials persuaded the military powers to reconsider steel, and even in England experiments were made to overcome its brittle features. Cammell and Brown "hard-faced" plates were one example of *compound* armour; a hard steel outer skin was cemented to a wrought-iron backing. Wilson's compound process ran molten steel on to a white-hot wrought-iron foundation, and Ellis plating was made by running molten steel into a sandwich composed of a thin steel face-plate and a wrought-iron base.

A good specimen of this transition period was *Collingwood*, 9,159 tons, laid down in 1880. She was built of steel, and her armour was of steel-faced compound type, 18 ins. thick throughout the central belt. Rotating turrets were not employed; the guns were placed on barbette towers, which were armoured 12 ins. thick. A secondary armament of six broadside guns was mounted, and was protected from raking fire by screens of 6 in. armour fore and aft. These screens extended from the barbette towers to the sides of the ship.

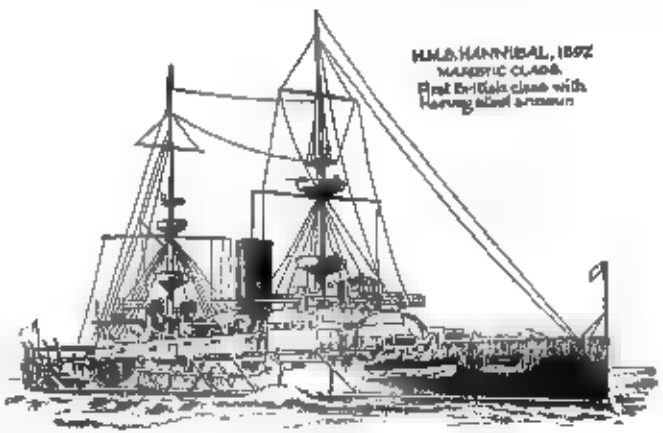
At the same time, *Polyphemus*, 2,640 tons, figured on the Navy list as a torpedo-ram. This unusual vessel was shaped like a submarine, and she ran partly submerged. The part above the water was armoured with [illegible] ins. of steel. *Polyphemus* was armed with a steel ram, a Whitehead torpedo, and Nordenfelt machine-guns in revolving turrets.

After long and searching trials, compound armour was judged inferior to Schneider's solid steel, as the wrought-iron base did not afford enough support. However, the hard surface of the face-plate on compound armour was a desirable feature, and experiments in Russia and America drew attention to this in 1890.

Captain Tresidder found that water-jets played upon a hot steel plate hardened the surface more than the plunging

method; the latter produced excessive steam which detracted from the hardening effect. At the same time the Harvey process was perfected in America. It was based on carbonisation of the face of armour plate, extending to a depth of several inches. By the time these two types of armour-plate were introduced, steel armour-piercing shot had displaced chilled iron. The former had tough bodies, and their heads, hardened with water or oil, were able to penetrate a calibre or more into ordinary steel armour and rebound undamaged. They could be fired at armour again and again with the same result.

Against the new face-hardened armour this tough shot smashed to fragments, so wrought-iron or steel caps were applied to the shot to enable it to hold together. Britain adopted Harveyised armour in 1892, though at first it had the technical defect that a plate over 5 ins. thick tended to contort in making, through the effect of face-hardening. H.M.S. *Majestic*, 1895, the name-ship of a new class of powerful battleship, was the first British warship to be protected with Harvey armour. She had a central belt 217 ft. long, 15 ft. deep, and 9 ins. thick, with an armoured lower deck from 2½ ins. to 4 ins. thick. Barbette towers and casemates were 14



ins. and 6 ins. thick respectively. *Majestic*'s dimensions were 390 ft. by 75 ft. beam, and she displaced 14,900 tons.

In the same year, 1895, the great German firm of Krupp startled the military world over a series of experiments made with Krupp nickel steel plate. Nickel had been on trial for several years. American authorities had been so impressed in 1890 by the performance of a 10½ in. Schneider steel plate containing nickel that this ingredient was shortly included in American armour plate.

The Admiralty held back until the new process should have proved itself, but it was soon obvious that the judicious ▬ of nickel gave steel tremendous toughness without face-hardening. In the 1895 trials, an 11·8 in. Krupp plate resisted three 12 in. missiles, which broke off, leaving their heads wedged in the armour. This demonstration, and others, convinced the British authorities, and nickel steel armour was adopted for the Navy in 1896. A curious feature of the gun-armour contest was the constant use of solid shot for armour-piercing. Captain Orde-Browne, writing in 1903, disparaged the idea of explosive armour-piercing shells, as lacking the penetration to carry their charges inside the plating.

Meanwhile, the defences of coastal and inland forts had been receiving attention ▬ the Continent. As before, it was considered that coast armour would be subjected to short-lived attacks from very heavy naval guns. Chilled iron of Gruson's production was employed for coastal forts, after testing with shells from a 100-ton gun of 17·2 calibre. Inland forts, liable to sustain prolonged bombardments from mobile siege guns of lesser calibre, were accorded the non-shatter defence of nickel steel. British forts were still encased in sandwiched wrought iron, with provision for strengthening layers as required. An admitted drawback was that bolts or other débris might be driven in to fly around the emplacement and cause injury.

Sword, Farewell

For a hundred years there was taking place the gradual eclipse of the blade by the bullet. The symbol of the soldier was to become the rifle instead of the sword, though the latter held on gallantly until after the 1914 war. Throughout the nineteenth century opinion was still sharply divided on the best form of sword. Most military authorities favoured the thrust, but there was yet considerable support for the use of the edge. One drawback of the latter [redacted] that skill and training were required to keep the edge leading, otherwise the blade would turn and strike only with the flat. Report has it (*Cavalry Journal*, Vol. 1) that in the charge of the Light Brigade at Balaclava only two Russian gunners were killed by sabre-cuts.

No amount of discussion could alter the fact that there never would be a sword equally suitable for cutting and thrusting. The best conclusion was but a revival of seventeenth century tactics – the point for the charge and the edge for close quarters, where the point could not be easily used. At last a British commission of 1906 agreed to concentrate on a thrusting sword, and the 1908 pattern cavalry sword was evolved. It had a tapered, down-bent grip, a bowl guard, and a relatively narrow blade, and it has been described as the finest service sword of this type ever to be designed.

This was the evening of the sword in war. During the First World War, infantry officers found that modern conditions rendered their swords a complete anachronism. Among the cavalry, a significant feature confirmed the decline of the sword – light machine-guns, such as the strip-fed Hotchkiss,

were carried into action. In effect, the cavalry were making [redacted] of the weapon that had made their swords useless.

After the war, swords appeared only at ceremonial parades and displays, with the exception of some isolated frontier campaigns, and today the sword is worn only on special occasions. In the early part of the Second World War, Japanese officers carried swords into action, but it was chiefly in deference to tradition. However, it is fitting that, after thirty centuries of active service, the sword should still be retained [redacted] a symbol on so many State occasions, and as an award for proficiency in military training.

An important part is played by the five swords that figure in the magnificent Coronation ceremony of the British Sovereigns. These are, namely, the great two-hand Sword of State, the obtusely-pointed Sword of Spiritual Justice, the sharp Sword of Temporal Justice, pointless Curtana, the Sword of Mercy, and the Jewelled Sword of State, which last cost £6,000 when it was made for the Coronation of George IV in 1821. The Swords are gorgeously embellished on hilt and scabbard with scarlet velvet, cloth of tissue, gold, and jewels.

Another great occasion centring upon [redacted] sword is the ceremonial entry of the reigning Sovereign into the City of Lon-

don. Here the Lord Mayor in submission presents the City Sword, of mediaeval form, and receives it again. The small-sword, too, has its part in ceremony, when employed by the Sovereign to bestow the *accolade*, by which a knighthood is conferred. In this case the ceremony consists of a tap upon each shoulder of the kneeling candidate. Small-swords are worn with court-dress on important occasions, and the Serjeant-at-Arms in the House of Commons regularly appears in this dress.

During the Second World War, the heroic Russian defence of Stalingrad impelled the British to make a special sword and present it to the citizens of that town, in token of admiration for their gallantry. The Sword of Stalingrad was forged by Tom Beasley, aged eighty-five, famous swordsmith of the famous firm of Wilkinson. That firm has produced the majority of the swords made in this country over the last century.

On the Continent, the art of swordsmanship has been kept alive as a sport, as well as serving to maintain the practice of duelling in France. The Paris fencing master M. Jacob was the first to arrange a series of rules for play with the *épée-de-combat*, towards the end of the nineteenth century. He cut across the older practices of fence by abolishing the accepted bent-arm guard, where the sword was held point upward.

M. Jacob contended that the old guard laid the sword-arm open to attack, and that time and movement were wasted in bringing the point to bear. His alternative was to extend the arm fully, with the sword in line with it, so that the opponent was kept at a distance. No close attack could be made, unless the defending blade had been bound in or beaten, and a lunge could be made only at risk to the attacker. Unlike the play with the foils, a hit could be made anywhere on the person.

The French épée and foil both had plain grips, but the Italian pattern had a cross-guard with two rings inside the bowl-hilt. In play, the first and second fingers were inserted into the rings, in the manner of the early rapier-men. A wrist-strap was used for balance, as the grip was rather short.

There had been a revival of singlestick during the late nineteenth century. It entailed the [redacted] of the point, with hits allowed anywhere, but by about 1905 singlestick had given place to sabre play. This was due to the introduction into Britain of an Italian light sabre.

Previously, this form of sabre had been peculiar to German students, who used in their contests the narrow, flexible *Schläger*. Their practice was to mask the face except for the upper part of the left cheek, which formed the target for the opponent. Every German student aspiring to be a man of the world had a criss-cross of broad sabre scars on his left cheek, and the practice endured until quite recent times. Rommel, the famous German general of the Second World War, bore sabre [redacted] of this type.

The hold on the duelling sabre varied a good deal from that on the small-sword. Control was maintained with the first and little fingers, the heel of the hand bearing upon the very down-curved grip. Sabre fencing was more spectacular than small-sword play, with wide, free movements in using the edge. Most hits were cuts – to the head, to the right and left cheeks, the flank, the cut on the cuff, and the *banderole* (in theory, a cut from shoulder to waist).

While the sword was slowly moving into eclipse, there was continual recurrence of body-armour experiments during the nineteenth century. In the Italian struggles for freedom in 1848, sappers taking part in the siege of Rome wore special armour with steel helmets. Probably the most prominent use of armour in that century was the instance of the Kelly gang. These Australian bushrangers made armour from plough

irons, which proved very effective until the robbers were finally brought to book in 1880.

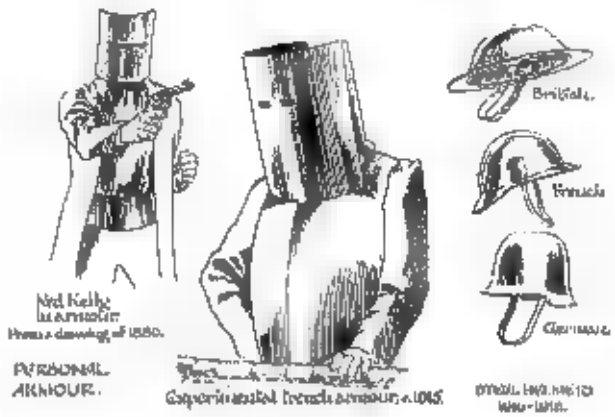
Later efforts by Sir Hiram Maxim and others produced hard steel breastplates in 1894. Though they were effective in stopping bullets, the weight of the defences – 10 lb. – was unpractical for any degree of movement.

At the same time, the making of high-quality mail continued to some degree, both in East and West. There was an instance of the successful use of mail, during the Egyptian War (1882–1898). An officer of the 5th Bengal cavalry allowed his wife to sew into his tunic a piece of mail she had bought. Shortly afterwards, in a hand-to-hand combat, the officer was speared in the breast. The mail stopped the blow so effectively that the spear-head remained hanging in it.

This form of defence for horsemen was further employed in 1887, when General Sir George Luck became Inspector-General of Cavalry. While fighting the Afghans with the 15th Hussars in 1878, the General had mail sleeves sewn into his tunic, as an efficient guard against the sharp draw-cuts of the curved Afghan swords. With this in view, the General issued a directive, when he took office, that cavalry officers should wear mail shoulder-straps. Each strap was composed of three hundred or more links of hard steel wire.

Apparently mail was favourably regarded by the civil authorities, for a writer of 1901 remarked that the English detective department held mail defences for wearing under the coat.

At the outbreak of war in 1914, both Allied and German troops went into action in normal uniform, with cloth caps. As the system of trench warfare developed, and torrential barrages of shellfire brought the perils of shrapnel and splinters, efforts were made on both sides to provide some personal protection. Various devices were tried in action – bullet-proof mail vests, rigid breastplates and helmets reminiscent of the Kelly gang, portable shields – but each had some drawback. A great



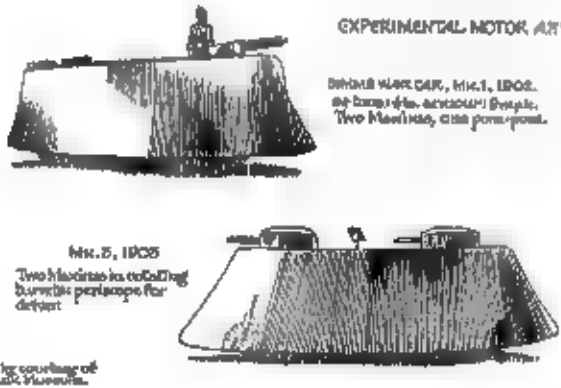
deterrent was the age-old peril of receiving a severe wound in spite of the protection, and bleeding to death before the armour could be removed.

By 1915 the matter was settled – the only practical defence to permit freedom of action with a degree of protection was the steel helmet, soon to be styled the *tin hat*. The British pattern was well-designed and serviceable, resembling in shape the mediaeval kettle-hat. It had a good glancing surface, and it contained a ring of rubber shock-absorbers. These were short lengths of thick rubber tubing, set vertically. When the wearer lay facing the enemy, the brim protected that part of his shoulders that was over his vital organs.

Another great point was that the British helmet could be easily mass-produced. This was the best steel helmet in use. The French helmet looked well, but it was too light, and though the German helmet was heavy, it tended to splinter.

At the beginning of the twentieth century, there came a stream of mobile-armour ideas, due to the greatly increased fire-power of small-arms. Armoured trains were in use during the Boer War (1899–1902) and in 1900 the Pennington armoured motor-car project was intended to produce the first practical fighting vehicle in Britain. It was designed as a 16 h.p. car with a deep skirt of ·25 in. armour surrounding the chassis, and reaching waist-high to the standing crew. Two Maxim guns were to be mounted behind shields, from which the vertical steering column would be controlled.

There was little official interest in the machine, or in a second design proposing heavier armour and armament. Shortly afterwards, in 1902, the Simms War Car appeared. It had an overall-armoured hull of ·25 in. thickness, with a fringe of mail hanging below to protect the tyres. Two Maxim guns



EXPERIMENTAL MOTOR ARVa.

Mk.5, 1903

Two Maxims in revolving turret: periscope for driver

were mounted astern, and the bow gun was an automatic one-pounder known as a pom-pom.

This car seems to have been of practical design. It weighed 6½ tons, with a top speed of 9 m.p.h. and a radius of two hundred miles. The 1903 pattern mounted revolving Maxim turrets fore and aft, and the driver steered by a form of periscope standing up amidships. Like the Pennington car, the Simms gained no support from the authorities, so the idea lapsed. Still, the seed had been planted – the internal combustion engine was allied with the armoured vehicle.

Even at this early date, a great deal of progress had been made in the other essential feature of the true battle-car – a means of crossing broken terrain. The first principles of the endless chain had been conceived by the Englishman Edgeworth (patent 1770). He attached a "portable railway" to a wheeled car, by arranging several sections of wood in such a way that there was always a piece beneath each wheel. Later inventors developed the idea. Thomas German, in 1801, produced "a means of facilitating the transit of carriages by substituting endless chains or series of rollers for the ordinary wheels."

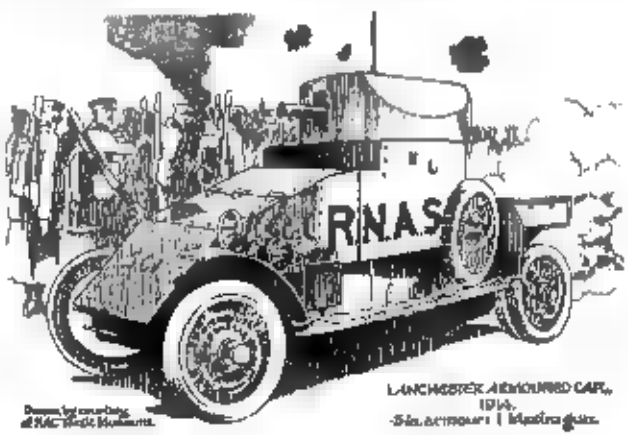
Sir George Cayley improved the system with his "universal railway", which had a small foot-wheel on each unit to permit sideways movement. The footed wheel was the basis of Andrew Dunlop's *pedrail* of 1861, a device that figured in some 1915 experiments. Guillaume Fender, of Buenos Aires, worked on the endless chain track, and John Newburn extended it to the full axle-base. Next, in 1886, the Applegarth machine known as a *tractor* (probably the first use of the name) had the front track-bearing wheels higher than the others, so that the raised track made obstacle-climbing possible. In the following year, the Batter tractor had a double track of exactly the same type as that used in 1916, and a steam engine drove each track.

From 1900 onwards petrol-engined vehicles were used in track-layer experiments. In 1908 a 75 m.p.h. Mercedes was tracked by the Hornsby Company, and the car did 20 m.p.h. across sandy country. At the same time the Holt Company of America adopted the caterpillar track, and Holt tractors were later examined by British experts during tank research work.

At the outbreak of the 1914 war, armoured cars were extensively used by France and Belgium, and British authorities followed suit. Rear-Admiral Sir Murray Sueter organised a fleet of such vehicles for the Royal Naval Air Service. A number of Rolls cars were temporarily armoured with 1 in. boards sandwiched between ¼ in. mild steel plates. Later, in December 1914, the first three revolving-turret Rolls cars were landed in France.

Other armoured cars were built by the British on Wolseley, Lanchester, and Delaunay-Belleville chassis. These vehicles had sloping frontal armour, but the Rolls retained its well-known lines even when plated. In each case, the armour was ·3 in. thick, and one Maxim gun was mounted in the turret.

Soon after the end of 1914, a heavier vehicle was produced



LANCHESTER ARMOURED CAR, 1914.

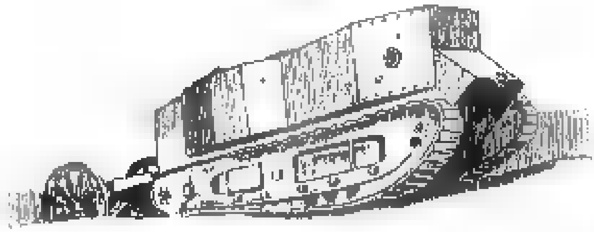
in the Seabrooke armoured truck, which appeared in February, 1915. Its plating was ·316 in. thick, and it was armed with a three-pounder gun behind a shield, supported by four Maxim guns. The Seabrooke operated with a crew of seven Naval Brigade men, and, though structurally defective, it did useful work in the Ypres territory. It formed a link between the light armoured car and the land-warship that was to come.

When the Germans "went to ground" on the Aisne, behind a tangle of barbed wire bristling with machine-guns, the armoured vehicles then in use could do little. After a number of terrific bombardments, designed to flatten the wire and blast a way through, the Allies had made no progress. Despite torrents of shells, large sections of the defences remained intact, and the dogged enemy crept from his dugouts to lash the waves of Allied infantry with his machine-guns.

A request for armoured fighting vehicles with tracked chassis was put forward in October, 1914, by Lieutenant-Colonel Swinton (later Major-General Sir E. D. Swinton). Though Mr Winston Churchill, First Lord of the Admiralty, urged this scheme most strongly, the Premier, Mr Asquith, would not hear of it. In June 1915, Colonel Swinton gained the support of Sir John French, commanding the British Expeditionary Force, but by that time an Admiralty committee was already in being, to discuss a possible land-ship. (Sir) Eustace D'Eyncourt was chairman, and expert advice was given by Lieutenant (later Major) W. G. Wilson and (Sir) William Tritton, of the William Foster Company, Lincoln.

Various trials were made, with coupled steam-rollers, pedrail and wheeled tractors. Steam engines were ruled out, as being deficient in weight–power ratio, so the petrol-engine was the obvious power-unit.

A Foster-Daimler 105 h.p. tractor was put on trial, and, though it was turned down in June, 1915, its chassis was the basis of *Little Willie*, built in September, 1915. King George V



[illegible] "LITTLE WILLIE," 1915.
[illegible]

witnessed the trials of the new land-ship at Thetford Heath, Norfolk, in the same month. *Little Willie* (named after the derisive title applied to the German Crown Prince Wilhelm) was 26½ ft. long, weighed 28 tons, and travelled at 3½ m.p.h. As shown in our picture, the track ran low upon the body, and a pair of tail wheels trailed behind to help the steering. The wheels were 4 ft. 6 ins. in diameter; they were held to the ground by sixteen heavy coil springs, and hand-worked wire ropes swung them for slight turns. In making a sharp turn, the tail was raised hydraulically, and the vehicle turned on one track.

Though generally successful, *Little Willie* was poorly balanced and unsatisfactory on trench-crossing, so *Big Willie*

"BIG WILLIE," 1915.
PROTOTYPE OF Mk. I TANK.
[illegible]

[illegible]

Mk. V 1917.
[illegible]

Drawn by courtesy of RAC Tank Museum.

was developed from the prototype. In this design, the tracks ran right around the body of the vehicle, which was of rhomboidal form. Mark I was tested at Lincoln in January, 1916, and a hundred machines were ordered.

About a month before the trials, the Tank Supply Committee was in operation. The name is said to have arisen from a security scheme to conceal the nature of the British device. When the first thirteen vehicles were despatched to France in mid-August, 1916, they travelled in huge packing-cases labelled "Water tanks". They were sent to the training centre at Abbeville, where their crews, a special unit of the Machine Gun Corps, were under the command of Lieutenant-Colonel Swinton. (The Tank Corps, as a separate unit except for cavalry armoured cars, was organised in 1917.)

Tanks Under [redacted]

At last the ambition of centuries had been achieved. There stood on the battlefield a mobile fortress, armed and armoured as never before.

Mark I was made in two classes, "male" and "female" machines. They resembled each other [redacted] all points but weight and armament. The male weighed 28 tons (female 27 tons), and was armed with two Hotchkiss six-pounder quick-firing guns in *sponsons* (side blisters) and four light machine-guns. Bicycle saddles for the gunners were attached to the guns. On the female machines were five machine-guns, with 31,000 rounds of ammunition. In each [redacted] the overall length of the tank was 26½ ft., with a 6 ft. steering tail. The overall width was just under 14 ft. and the height 8 ft., with 16½ in.

ground clearance. Armour plating ranged between 6 mm. and 12 mm.

A crew of eight manned the tank – commander, driver, two gearsmen, and four gunners. Steering was effected by separate gearboxes for the two tracks, with a [redacted] serving each. When a turn was necessary, the driver locked the differential, rapped on the engine cover, and signalled with his fingers to the gearsmen. On the turn side, neutral was engaged, and the opposite gearbox remained in high or low gear. For a sharp turn, the track brake was applied on the side concerned. The tail wheels were soon abandoned, as being too clumsy and vulnerable to shellfire.

There were many defects in Mark I. It was not easy to enter or leave the machine, and ventilation was very bad. The drive chains were exposed to dirt, no silencer was fitted, and flames from the exhaust were visible at night. If the engine stopped, it had to be cranked from the outside, for the interior crank-starter was behind the driver's seat in the most unworkable position. The radius of action was 23 miles, on a 46-gallon petrol tank, with a road speed of 3·7 m.p.h. Trenches up to 10 ft. wide could be crossed, and the machine could go over a 4½ ft. obstacle.

Nearly all British tanks of the 1914–18 war were of rigid suspension, with no springs. Each track was formed of 90 flat armour plates, with *grousers* or ridges to provide extra grip. On Mark I the sponsons were removable for ease in rail travel. This operation meant hours of heavy work for the crew, and a trailer had to be provided to tow the detached sponsons behind the vehicle. In later Marks (from Mark IV onwards) the sponsons could be swung inboard.

One of the most curious things about the tank story is that the type of machine that first went to France was actually inferior to one that had been designed in 1912. Drawings for the latter were submitted to the War Office by E. L. de la

Mole, of North Adelaide, Australia, and these drawings show the same general form ■ the tank of 1916. Through official negligence, the designs were pigeon-holed at the War Office, and were never considered.

Early in September, 1916, the first detachment of tanks was ready to leave Abbeville for the Front, and between the 7th and 9th of the month they were moved forward. On the 15th, forty-nine machines entered the first battle of the Somme – mobile armour going into action as an effective unit for the first time in history.

Apparently the Germans had received no warning of the secret weapon. In fact, their government had refused offers of armoured fighting vehicles on two occasions (1913 and 1916), on the assumption that they would not be needed in a war of movement. Accordingly, the German front-line troops were taken completely by surprise when the crashing, bellowing steel monsters came rolling and lurching towards them.

A heavy opening barrage had torn the ground very badly, and this drawback, together with some failures at the start, greatly reduced the effective number of the land warships. Seventeen were hopelessly bogged down – a dangerous situation, for they became sitting targets, and no tank could stand a direct hit from a shell of any size. Only nine machines finally reached their objective, but the effect on the morale of the German troops was still very considerable.

On the British side, ■ number of points were brought out by the first historic action in tanks. The gravity petrol feed failed when the machine was ditched nose downwards, and the carburettors had to be fed by hand. Another vital matter was the effect of small-arm ammunition against the armour-plate. It did not penetrate, but the impact caused flakes to fly off inside, as in an enamelled vessel when struck. This endangered the faces and eyes of the crew, so they were issued with special masks of leather, steel, and mail – a curious revival for the latter.

In the following spring, at the battle of Bullecourt (April, 1917), the Germans captured two Mark I tanks, and found that their K-type armour-piercing bullets had gone through the plating. When the British learned of the effect of this A.-P. ammunition, further Marks with 14 mm. armour were built.

One small side issue was the changeover of light machine-guns for the tanks. Some machines were armed with Lewis guns, the barrels and radiators being enclosed in outer casings. When the tank became a more familiar object to the German soldier, some daring spirit would creep alongside one that was moving slowly. Inside, the machine-gunner would be peering through his loophole, his face close to the butt. If the man outside seized the gun-casing and swung the gun violently on its swivel, the gunner received a severe blow on the jaw. This manœuvre was countered by replacing the Lewis with the Hotchkiss, the bare barrel of which heated up on firing. Any would-be gun-swinger who seized on the Hotchkiss would have left some of his skin sticking to the barrel.

A feature of the earlier Marks was a wire-netting top cage, with sloping sides like a chicken-run. This was designed to protect the crew from daring grenade-throwers, who either lobbed their bombs on top of the tank or climbed up to pry open the manhole and drop their missiles inside.

Mark V, designed in October, 1917, showed improvements in addition to stouter armour. Its 150 h.p. engine gave 4·6 m.p.h., and the driver controlled the tracks through epicyclic gears instead of having separate gearboxes with gearsmen. There were four separate entrances – a manhole in the turret, a rear door, and a door in each sponson. This feature had been included in Mark IV, as had the *unditching beams*. The latter lay along the top of the tank, and could be attached to the track. If the tank became ditched, the track carried the beams underneath and provided a ramp to bring the machine up to level ground. A previous idea had been the *torpedo*

spud, a short bar attached across the track, but this was not so effective.

Inside the tank, more room was provided around the crank-starter, so that four men could work at the crank. Here there was a grave defect in the fitting of an internal radiator. Bad ventilation combined with exhaust fumes caused the crew great discomfort, and almost poisoned the infantry who were occasionally carried.

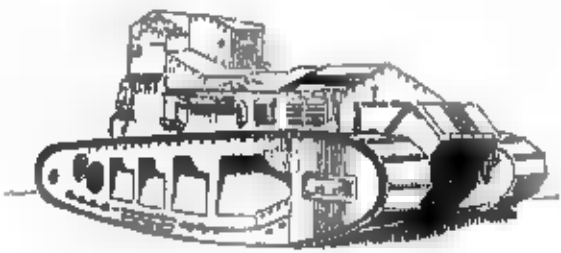
There was little outlook in any of the machines. Tiny peep-holes were provided in the visor-plates at the front, and the commander had a prismatic glass device like a short periscope, but bullets soon destroyed this. Usually, the crew depended upon maps, compass, and preliminary survey of the terrain. Advance routes were so carefully planned that infantry units often depended upon their tanks for guidance. A number of signalling devices, more or less successful, were employed between tank and tank, troops and tank, and vice versa. Carrier pigeons, collapsible semaphores, flashing lights, and bells were all in use, while white and red recognition marks were frequently painted on tanks.

Constant efforts were being made to improve performance, especially in trench-crossing. A ten-foot crossing capacity soon proved ineffective for static conditions on a dug-in front, so trench-fillers were devised, to be carried on the tank. *Fascines*, or large bundles of brushwood, were first tried, with some success. An improved idea was the *crib*, an iron-bound wooden frame, but both were temporary measures. A lengthened Mark V tank, produced by the Tank Corps Central Workshops in France, gave the new 34-ton, 32½ ft. machine a crossing of thirteen feet, with a capacity sufficient to carry 25 troops.

Other Marks followed, with various points of improvement, but the higher Marks were not produced in any quantity by Britain. Mark VIII, December 1917, was adopted by the

U.S. Army. This tank was 34 ft. long, and it weighed 37 tons. At the same time, the British forces were using a supply tank, Mark IX, designed in September, 1917, by Lieutenant Rackham. It was based on Mark V, but was arranged to carry 50 men or 10 tons of stores. This type of tank could tow a train of several sledges to increase the load capacity.

Another important newcomer among the land warships was the *whippet* tank. Sir William Tritton designed this in December, 1916, for relatively open warfare. It was a 14-ton, 20-ft. machine with a low-level track like the original *Little Willie*. *Medium Mark A*, the first whippet, could range over 80 miles of rough country at 8·3 m.p.h., under the control of



"WHIPPET," 1918: FIRST LIGHT TANK.

one man. There was a crew of three, and the whippet was armed with four Hotchkiss guns, behind 14 mm. plate. One of the intended functions was to co-operate with cavalry by clearing the path of an advance, but there was no practicable provision for signalling, so this combined operation rarely took place. The whippet's first action was fought at Hebuterne, in March, 1918, and two hundred were in service by the end of the war.

Though the French army of 1916 faced the same barbed-wire problem as the British, they had no great success with their tanks. Primitive armoured boxes on Holt tractor chassis were made by two firms, Schneider and St Chamond. These

machines were first used at Berry-au-Bac, April–May, 1917, without much effect, though the Schneider had 25 mm. armour and the St Chamond CHAR 17 mm.

More successful was the Renault FT light tank, built in 1916 but first used in May, 1918. It had the spring suspension common among French tanks, and its 39 h.p. engine gave 6 m.p.h. Armour ranging from 8 mm. to 16 mm. was fitted, and the revolving turret was armed with a Hotchkiss machine-gun.

This useful vehicle was the basis of an American light tank, for when America entered the war in 1917 she had no tanks and few men with any knowledge of tank warfare. The American Renault-type machines weighed 6 tons, and some of them had radio equipment in the turret. Another adapted form resembled the British Mark VIII, as already mentioned. It was ■ 6 m.p.h. vehicle weighing 35 tons, with two six-pounders and seven machine-guns.

In the first American tank engagement, at St Mihiel, in September, 1918, the crews went into action in borrowed tanks. From that time onwards, American-made tanks were used, and twenty-eight actions were fought in support of their own or British troops.

The Germans never caught up on tank production. A number of British tanks were captured and used against the Allied troops, but the first German machine was not brought into action until March, 1918. This was A7V, an ill-designed vehicle whose height (11½ ft.) was too great for its length (24 ft.). The result was a poor performance over rough country and across trenches – a six-foot trench was the limit. A7V weighed 33 tons, and travelled ■ 8 m.p.h. to a range of 50 miles on a 132-gallon petrol-tank. Her armour ranged from ·59 in. to 1·18 in., and was proof against 37 mm. shells, while her own weapons comprised a 57 mm. gun, mounted centrally in the bow, and six machine-guns. The crew numbered eighteen.

It was with A7V that the Germans fought and lost the first tank-to-tank action on record, at Villers-Bretonneux in April, 1918. Three German tanks had put two female Mark IV's out of action when a male Mark IV routed the three. One A7V overturned after being hit – clear proof of its ill-balanced design.

Deficiency in tank numbers meant that Germany was always at a disadvantage in this type of action. In the six engagements where German tanks appeared, there were never more than thirteen together. For this reason the German authorities concentrated on anti-tank weapons – rifles and cannon with armour-piercing missiles, land-mines, and flame-throwers. When the Armistice was signed in November, 1918, German tank production was still hopelessly behind through a short-sighted lack of priority until it was too late. Two massive "K" class *panzerkampfwagenen* (armoured battle cars) were almost completed by the end of the war. The K machine weighed 165 tons, with a crew of twenty-two, four 77 mm. guns, and six Maxims.

Floating and Flying Armour

At the outbreak of war in 1914, Britain had the most formidable navy in the world. Long years of trial and experiment had produced capital ships armed and armoured with maximum efficiency. The general arrangement of ship armour had varied very little since the end of the nineteenth century, and, of course, it was chiefly employed on capital ships, the heavyweight fighters of the fleet. Cruisers, the middleweights, had scarcely any side armour, and their turret armour was reduced

to a few inches, because the cruiser's main defence was speed.

On board the lightweight destroyers, the hit-and-run greyhounds of the fleet, there was scarcely a plate that would stop a rifle bullet. Only ships that were designed to take punishment by standing toe to toe with the enemy were fitted out with heavy, speed-lowering defences.

The British Navy's battleships comprised vessels dating between 1894 and 1913, variously armoured. Britain had introduced in 1906 the *Dreadnought* class, with ten 12-in. guns and an armour belt of 11 ins. In 1914 the latest ship of the class was *Iron Duke*, Admiral Jellicoe's flagship at Jutland.

Thirteen more capital ships were built during the war, including *Queen Elizabeth*, flagship, with nickel steel armour 10–13 ins. thick, and the world-famous battle-cruiser *Hood*. Battle-cruisers were a special class, with slightly reduced side-armour (12 ins. in this case) and much higher speed, but gunned like a battleship. *Hood* was the most powerful fighting ship in the world when she was completed in August, 1918, at a cost of £6,000,000. Displacing 42,100 tons, with a speed of 31 knots, she had a main armament of eight 15-in. guns. *Hood*'s armour weighed 13,800 tons in all. Along her sides were belts 12 ins. thick, and her gun-turrets were faced with 15-in. plates, the sides being 12 ins. thick. Naval experts considered *Hood* the finest and most successful man-o'-war ever built.

H.M. BATTLE CRUISER HOOD, 1918.
Armour (max. thick.) 15-in. guns.

However, the greatest naval action of the century had been fought before *Hood* came on the scene. At the end of May, 1916, British and German giants of the sea met in a titanic struggle off the shores of Jutland. Here was the testing-ground of ship armour, when the great 15-cwt. shells were roaring between the fortresses of steel. The battle cruisers of the two fleets were first engaged. Under the fire of *Von der Tann's* 11-in. shells, H.M.S. *Indefatigable* received two salvoes that penetrated her turret and barbette armour, of 7 in. thickness, and sank her in a few minutes. At the same time, *Queen Mary's* 9-in. armour was being battered by *Seydlitz* and *Derfflinger*, carrying 11-in. and 12-in. guns respectively. The British vessel sustained at least eight hits, and she was torn almost in two when she sank. As [redacted] the main British force came into action, the German High Seas Fleet was compelled to withdraw into a mined anchorage.

The Battle of Jutland was the only occasion in the whole of the ironclad story when a full-scale fleet action was mounted with all classes of armour. Millions of pounds were yet to be spent in building and refitting the huge steel gun-platforms, but already they were under a shadow. As the power of the aircraft and the bomb increased, far-seeing tacticians foretold the end of the battleship. To drive home the prophecy, the torpedo-plane, developed before 1918, was a growing menace to the surface ship.

At the same time, the aircraft-carrier was brought into being, and it seemed in later days that this would be the battleship's successor. Both vessels were heavy and unwieldy, and both required a screen of light craft in action, but the carrier could send and direct its blows further and more effectively than could the battleship.

As the twentieth century advanced, the battleship gained little in basic development, so, as in 1914, Britain entered the

war of 1939 with a navy that included many old and refitted warships. *Nelson* and *Rodney*, launched in 1925, were of unusual type, with nine 16-in. guns in triple turrets as part of a heavily armoured redoubt. A belt of 14-in. armour extended around two-thirds of the water-line, and there was an armoured deck 6¾ ins. thick. It was claimed at the time that no other warship in the world had such protection as these £7,500,000 ships. In 1937 five battleships of the King George V class were laid down, and the last of the great ironclads of the Royal Navy was H.M.S. *Vanguard*, 42,000 tons, launched in 1944. She cost £12,000,000 in all, though the war ended

LAST BRITISH BATTLESHIP H.M.S. VANGUARD, 1946 [illegible]
ARMOUR [illegible] COST £[illegible]

before she was commissioned. *Vanguard*'s armour belt was 14 ins. thick over the magazines, with turret face armour of 13 ins. and barbettes of 16 ins. As in all the newer battleships, there were armoured gratings across the funnel uptakes, which were themselves armoured.

During this time, carriers had gained in size, and they played a part of increasing importance. Though they were difficult to protect, [redacted] armoured deck was customary over a large part of the hull, at least. In their turn, large carriers were criticised for the massive stretch of flight deck that presented such an easy target from the air. Slowly the pattern of the new navy began to emerge – small, almost unarmoured surface craft for

escort duty and submarine hunting, small fast aircraft-carriers, and partly armoured submarines.

The huge battleship was employed to deal ponderous blows on occasion, but its weakness was proved by disastrous sinkings. *Hood* succumbed to the accurate gunfire of *Bismarck* (herself doomed) in 1941, and not long afterwards the new *Prince of Wales* and the *Repulse* were sunk by Japanese torpedo-bombers in the China Sea. In that part of the world, Japanese air power had previously dealt a shattering blow at American naval units in Pearl Harbour.

However, from off the Normandy beaches on D-day, in June, 1944, the great guns of Allied battleships poured hundreds of tons of exploding steel into the German positions. This was the ultimate function of these ships – antiquated floating platforms for big guns, a tremendous drain on the nation's purse for very limited uses. After the war, British battleships were withdrawn from service one by one, until the final requiem for the big ships was sung over *Vanguard*, which was laid up in 1956 and disposed of in 1959.

It had taken only ninety-odd years for the armoured ship to make its entry, rise to a position of vital importance, and then decline at a progressive rate as the air attack developed. Here was a triumph of missile over armour. Though 15 inches of diamond-hard steel encased the battleship's vitals, she was vulnerable to the bomb and the airborne torpedo.

While the floating fortress was still a considerable factor in war, the youngest fighting service was seeking protection. Even before the 1914 war began, that industrious pioneer Louis Blériot was at work on an armoured aircraft. This was a 160-h.p. two-seater, with the cockpits, engine, tanks and controls enclosed within a shell of 3-mm. chrome nickel steel, extending from the nose to behind the gunner's seat. Loopholes at the sides of the gunner's cockpit permitted beam fire. Underneath, the nacelle was rounded to deflect fire from below, and the

strut work was embedded in a papier-mâché casing, with canvas sewn over it. It was claimed that wood thus protected would not splinter if pierced.

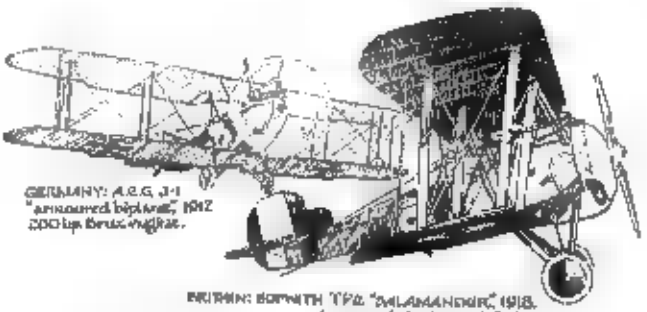
Aircraft protection was practised to some extent by the British authorities from the beginning of the 1914 war, and a good deal of thought was devoted to this during the later stages. At first, British armour consisted of aluminium sheeting, as on the Sopwith Tabloid Scout of 1914. In this machine there was an aluminium casing that completely enclosed the forepart and engine. A similar provision was made on the German LVG C-II of 1916.

By the middle of the war, aircraft were well established in their true role of overhead attacker instead of mobile observation post. When the use of close-support aircraft became common, and trench-*strafing* was a feature of air activities, further protection against small-arms fire became necessary. The development of the heavy bomber called for a measure of crew defence, so in both classes of aircraft armour was of value.

Hugo Junkers, serving as a pilot in the German forces, had been experimenting with metal construction since 1915, and late in January, 1917, his first metal plane, Junkers J.1, took the air. Its wings and tail assembly were covered with corrugated aluminium sheeting, and the forward part of the fuselage was sheathed in 5-mm. armour plate. At the rear, the fuselage was filled in with duraluminium tubing covered with fabric.

In the same year, the Germans brought out their A.E.G. J-1, known as "the armoured biplane". This craft was built of steel tubing covered with fabric, the fuselage being guarded at each side and underneath with one-piece 5-mm. armour plates. A stout bulkhead was built in at the back of the gunner's cockpit, the whole installation totalling 105 sq. ft. of armour and weighing nearly 9 cwt.

Though Britain had nothing to compare with this craft, the



AIRCRAFT OF WORLD WAR I.

use of plating was steadily increasing. Handley Page, in their O/400 bomber of 1917, provided armour plate to shield all crew positions, and the close-support Sopwith *Salamander* TFZ Scout (April 1918) was well armoured. Steel plates were arranged around the cockpits, under the fuselage and outside the fuel tanks, so that the whole forepart of the fuselage was encased in armour, to the weight of 650 lb. Production was slow, and only three went to France.

Aluminium defences were still used a great deal on both sides, though some types of aircraft, like the two Sopwith *Buffaloes* of 1918, had armour-plated forward sections as well. The French Nieuport 28 C.1 Scout mounted an aluminium engine covering, and apparently some of these machines had thick cardboard around the pilot's cockpit and over the forward sections. In most cases, a steel seat-plate was arranged under the pilot, to guard against attack from below.

This experience in the use of aircraft armour was of little value to Britain during the twenty-one years of uneasy peace, because she was leading the way in the ill-fated disarmament gesture of the 1930's. As a result, when the Second World War broke out, Britain was frantically trying to build up effective armed strength in the face of the most formidable air force in the world.

It soon became obvious that the great fire-power of the multi-gun fighter made armoured protection vital for aircraft. A new approach was made to the gun–armour contest, and three main classes of armour were devised for aircraft, to suit various contingencies.

Where there was likely to be intense point-blank gunfire, the best form of shield was face-hardened or depth-treated homogeneous armour-plate. Deflector plates of light steel or aluminium could be used to advantage where the bullet's line of flight was at a considerable angle to the plate, 45° or over. These plates were designed to tumble the bullet so that it did not deliver its full force. Other shields of non-ferrous type were made of beryllium, bullet-proof glass, plywood, and composite materials. Our third example of protection is the leak-proof fuel tank, the resilient lining of which, when pierced, closed the hole at once. Tyres were similarly constructed.

There could be little difference in the actual disposition of the aircraft armour employed during the Second World War. Previous experience directed that a heavy plate should back the fighter pilot's seat, with flanges of a light alloy arranged beneath. The enclosing canopy was made of bullet-proof glass, or some form of transparent compound with similar protective qualities. Over the nose of the fighter were deflector plates of non-ferrous alloy to cover the engine and instrument board.

On the multi-engined bombers, etc., there was a considerable amount of protective plating. All front gunners' positions and bomb-sight points were covered by heavy frontal armour and lighter side wings. Around the pilot's seat was built up a guard of thick top plates with light supporting shields, and all middle and rear gun-points were protected with heavy armour plate at the vital angles. The floor and the lower part of the fuselage were covered with aluminium plating.

These forms of defensive work were intended to resist small-

arms fire and splinters. It had taken a relatively short time for aircraft armour to reach a high standard, but its value was depleted by the successful post-war A.-A. rockets. By that time the aircraft itself was coming to be regarded as a second-line unit, and when the guided missile could pursue and "home" upon a given aircraft, ■ at Quemoy in 1958, armour was useless.

Tanks Holding the ■

After the Armistice of 1918, tank designers were able to give their full consideration to the problems shown up on the battlefield. While action was going on, the accent was on production; as long ■ the tank in hand was serving reasonably well, the demands of the fighting front did not allow for much experiment along new lines.

Three main requirements were plain – more speed, greater range, and better manœuvring. These improvements could not easily be made with a large tank, so both machine and armour were reduced in weight until the plating was only enough to keep out ordinary small-arms fire. Though such a tank could not face cannon even of the smallest calibre, it was considered that speed and handiness would protect the vehicle.

These were the views of enthusiasts, but British military opinion ■ sharply divided over the continued ■ of the tank. As matters stood at the close of the war, the Tank Corps was highly organised, with a good supply of service tanks that permitted considerable mobility across country. Special duty machines were being developed for other tasks – the mine-exploder (a Mark V R.E. tank pushing ahead a heavy roller),

a mortar tank, an armoured troop-carrier, and improved salvage tanks. The Allied armies had huge tank-building programmes, with a proposed aggregate of 8,000 tanks and 10,000 cross-country supply vehicles.

Despite the proved value of the tank in war, there was afterwards a decided move towards pre-1914 conditions, for economy reasons. In France, Marshal Pétain declared for a "lineal" policy – waves of light tanks alternating with infantry, in the wake of heavier tanks if trenches had to be crossed. Infantry battalions were to have sixty 37-mm. anti-tank guns each.

Pétain's organisation seemed to be in direct opposition to the tactics that had been developing late in the war, wherein tanks and aircraft could co-operate to clear a path for motorised infantry. Colonel (General) de Gaulle disagreed with Pétain, and supported the latter system, but he was not heeded. The French official policy, combined with the equally out-of-date linear defence of forts, greatly contributed to the fall of France in May, 1940.

British authorities were persuaded to retain three tank battalions, but no attempt at progress was made until 1926. An additional tank battalion had then been formed, and eight Territorial Armoured Car Companies had been attached to the Tank Corps. The first machine to be actually put in production after 1918 was the Vickers Medium, which was designed in 1921 and delivered in 1924. Mark I had spring suspension of the type introduced by French wartime tanks, as well as the first form of all-round turret traverse, and geared elevation for the gun. Though the springing allowed high speed, a defect was the consequent wear on the tracks, which soon gave out.

This 12-ton tank was 17½ ft. long, with a road speed of 15¼ m.p.h. and a radius of 150 miles in top gear. Starting was improved by fitting a hand magneto and a half-compression device. The five men aboard – commander, driver, operator, and

two gunners – were protected by 8 mm. armour. A three-pounder quick-firing gun was mounted in the turret, where four Hotchkiss light machine-guns were carried free, and a Vickers gun was mounted at each side ■ give a beam fire. In a modified vehicle, Mark Ia*, the quick-firer had a Vickers mounted co-axially – i.e., the two guns pivoted together. This was the first use of co-axial mounting in ■ tank.

When Mark II appeared in 1926, it showed an improvement in the use of armoured skirting plates to shield the suspension. Mark II weighed 16 tons, and it was a trifle slower, though it had the advantage of steering clutches designed by Major Rackham, of wartime fame. Vickers Medium tanks remained the standard machine of the Royal Tank Corps until 1938, and they were still being used for training in 1941.

One outstanding feature of post-1918 tanks in Britain was the effort towards a light tank of little cost, to be manned by a crew of three or less. Two devoted pioneers who gained little encouragement ■ tangible reward were Major G. le Q. Martel and Captain Carden. These inventors built a number of experimental machines, including an amphibious tank (1931), but the Vickers Company were the first large-scale promoters of a suitable light-armoured vehicle in 1929, Captain Carden being employed as designer.

The Vickers 4½-ton light tank, Mark I, was a two-man vehicle with 4-mm. to 14-mm. armour, and a top speed of 32 m.p.h. It carried one Vickers gun in ■ turret. Further Marks were varied with thicker armour, weight readjustment, and track broadening. Mark V of 1935 had a two-man turret, with a ·5 and a ·303 gun on a co-axial mounting. Last of the series was Mark VI, in which the Vickers guns were replaced by 15-mm. and 7·92-mm. Besa guns. This machine was largely represented in British tank units in 1939. It proved useful in France, the Western Desert, Greece and Crete, during the early part of the Second World War.

Another form of light tank by Vickers Armstrongs was their *Tetrarch* of 1939. It was a 7½-ton, 37 m.p.h. machine, with independent springing and pneumatic shock absorbers. One of its steering methods was the pivoting of the wheels, which bowed the track to make the turn required. *Tetrarch* was armed with a two-pounder and a 7·92-mm. Besa mounted co-axially in a turret, and it had 16-mm. armour. These tanks were flown in gliders to take part in the Allied invasion of Normandy in June, 1944.

Soon after the tank revival of the 1920's, British military experts were planning the organisation of a tank fleet. That term is appropriate, for the tank was a land-ship, to be manœuvred like the units of a naval fleet. It was decided that there were three practical applications – the light tank, corresponding to the ultra-mobile, high-speed destroyer, lightly armed and armoured; the middle-weight *cruiser* tank, for general action and maintaining contact with the enemy; and the heavy "infantry tank", the battleship, that would smash a way for following troops and iron out strong-points.

Sir John Carden (formerly Captain Carden) of Vickers Armstrongs, designed the first British cruiser tank in 1934. He intended it for fighting or close support for infantry, so the main weapon was a two-pounder, a three-pounder, or a 3·7 mortar, co-axial with a Vickers gun. Two more Vickers were in small forward turrets. Cruiser tank A9 weighed 12½ tons, and was armoured to 14 mm., its road speed being 28 m.p.h. This was the first tank to mount a power-traverse turret.

A9 was considered to be a good basis for an infantry tank, and the designer was asked to produce such a machine on similar lines. The main difference was the 1-in. armour specified, but this was achieved by building up additional plates – the first instance of composite tank-armour. A10, Mark I, was armed with a two-pounder and a Vickers, the armament being expanded in later Marks. This machine was found to be more

reliable than A9, though much slower, and some were used in the early years of the Second World War.

Later cruiser tanks included A13, the first British tank with Christie suspension, embodying hydraulic shock absorbers, and the *Covenanter*, designed by the L.M.S. Railway Company. The latter had 50-mm. armour, but it was only used for training. Another well-known name was that of the *Crusader*, designed by the Mechanisation Board after 1938, in collaboration with Nuffield Mechanisations. *Crusader* was the last cruiser tank of peace-time design. Mark I weighed just over 18 tons, with 40-mm. armour (increased to 52 mm. in Mark III), an armament of a two-pounder and two Besas. Its road speed was 27 m.p.h. In action, *Crusader* proved too thinly armoured, and though its speed and suspension were good, it was unpopular as requiring too much servicing.

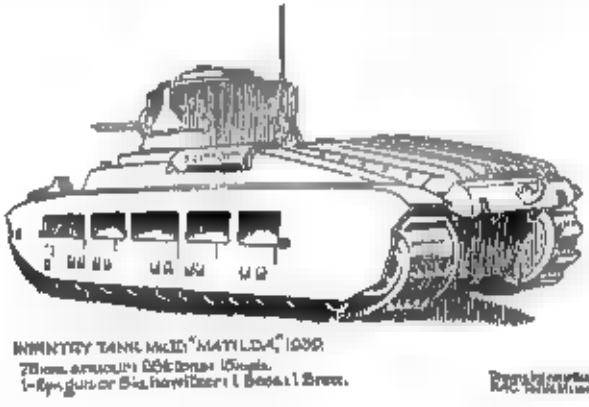
This development of armoured fighting vehicles naturally led to corresponding efforts in gunnery, since gun and armour had been waging a ding-dong battle for centuries. Until a few years before the Second World War, British tank armour was proof only against armour-piercing small-arm missiles. When widespread experiments with anti-tank cannon were being made, the armour makers had to bestir themselves. Their counter-move was the infantry tank, the heavy-weight, that could withstand punishment and hit hard in return when making frontal assaults to clear a path for the infantry.

Once again Sir John Carden [redacted] to the fore in designing the first true infantry tank in the British forces, Mark I, built in 1936 by Vickers Armstrongs. It mounted only one Vickers gun, but its armour was 60–65 mm. thick, and its turret was of cast armour-steel – a new departure that caused some trouble in production.

Mark I was not a good fighting tank, but its reliable structure and simple steering were valuable examples of tank engineering. Shortly after the appearance of this vehicle, the Mech-

anisation Board designed Mark II, the famous *Matilda*, which was built in 1939. It proved to be a most popular machine among tank crews, though it was not suitable for mass production. *Matilda* was heavily armoured, up to 78 mm., and heavy skirting armour protected her bogies. Engine and automatic gearbox were shielded by armoured louvres so heavy that though they were in sections, it took two men to lift each section.

The tank weighed 26½ tons, and was 19½ ft. long. She carried a crew of four, and moved at 15 m.p.h. In action, she was found to be under-gunned, as she carried the old armament of



INFANTRY TANK MK.II "MATILDA," 1939.
78mm. armour; 65½ tons; 15m.p.h.
1-2pr. gun or 3½in. howitzer; 1 Besa; 1 Bren.

a two-pounder with a 7·92-mm. Besa, plus a Bren for A.-A. fire. However, many *Matildas* were sent to the Russians, who thought highly of them. Some were converted to flail-tanks to beat paths through minefields. A rotating drum with lengths of chain attached was carried out [redacted] booms in front of the tank. As the chains beat the ground, mines at less than four inches depth were detonated over a width of ten feet. This device was first used at El Alamein in 1942.

Vickers Armstrongs' *Valentine* was the last infantry tank of pre-war design (1939). When it was converted to diesel and a new link-type track, it was for a time the most prominent

British tank. Though its comfortless driver's seat and hard-work steering made it tiring to drive, *Valentine* was well regarded by tank personnel. As usual, the early Marks mounted the two-pounder, but 57-mm. (six-pounder) or 75-mm. guns were carried on later machines. Mark XI carried the latter, with a 7·92-mm. Besa and an A.-A. Bren. *Valentine's* weight was 17 tons, and she was 18 ft. long, with armour of 65 mm.

The Tank

Barely three years after the Armistice of 1918, defeated Germany was already laying the foundations of another bid for power. Her Army Service Corps, established to preserve internal peace in the subjected country, received a number of armoured for use in civil broils. In this way was set up the basis of a future light armoured division, just the heavily armed Green Police were a potential *Wehrmacht*, and the air mail pilots who practised dropping mail-bags at set points were bombers in the making. By 1923 motor-cyclist companies (*Krad-Schutzen*) were added to the "security forces".

Secret plans for Germany's great venture into mobile armour were hatched apace. Before 1926 the *Rheinmetall* tank of about 22 tons, with a 75-mm. gun, was being covertly built and tested. A number of other designs followed, so that by the time Germany had officially begun to build tanks, in 1933, her builders already had considerable experience.

One of the grave omissions of the Versailles Treaty, governing German armaments, was that no restriction was placed on Germany's output of purely defensive arms. The German genius for engineering could thus be concentrated quite openly

upon anti-tank weapons. In 1933, when Hitler gained control of the Reich, there was at hand an unequalled defence in this respect. Therefore, as soon as Hitler began to set aside the disarmament clauses imposed by the Allies, he was able to build his great offensive force upon a superb defence. In this he was aided by two able tacticians, Colonel Heinz Guderian and General Ludwig von Eimannsberger.

Guderian wrote in 1933 his tactical work *Achtung! Panzer* (Attention, armour) describing his ideas ■ combining tank and aircraft in attack. A year later von Eimannsberger, well known for his work on tank theory, published *Der Kampfwagenkrieg* (literally, Battle-car war, or Tank Warfare). The first publicised effort of the German tank-builders was *Panzerkampfwagen* I (PzKw I), a six-ton light tank that became the standard machine of its class in German armoured units at the beginning of the Second World War. This machine, combined with PzKw II (1934: 10½ tons, 30 m.p.h., armoured to 30 mm.) and PzKw III (1936: ■ tons, 22 m.p.h., armoured to 70 mm.) formed the greater part of the German armour for the first half of the 1939 war.

It happened that, in 1936, the German General Staff were provided with an ideal testing ground, giving active service conditions – the battlefields of the Spanish Civil War. German "volunteers" with General Franco's army were able to put into practice the tank experts' theories – tanks and dive-bombers in combined attack, with A.-A. guns, especially the 88 mm., employed ■ anti-tank artillery in defence. These hard-hitting, long-range guns were well suited to oppose tanks. In the final stages of the Spanish war, it was claimed that 93 per cent of the shells fired by A.-A. guns were directed at ground targets, and only 7 per cent at aircraft.

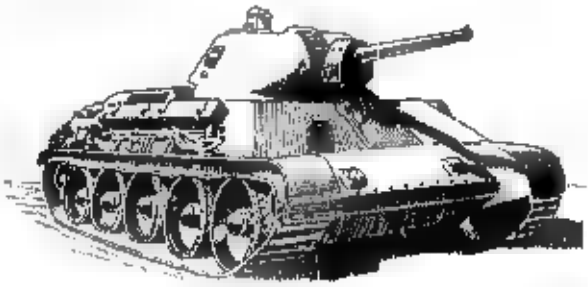
There could have been no better aid for Germany's formidable rearmament programme. Not only could fighting vehicles and weapons be tried out, but a core of troops with battle ex-

perience could be built up as the nucleus of a highly trained fighting force. On the basis of experience gained, the Nazis formed an immensely strong armoured section. At the outbreak of the Second World War at least ten tank divisions were in existence, with others forming.

Britain, on the contrary, had only one division in process of formation, despite the devoted work of the tank enthusiasts in promoting improved design. Though there had been a drastic reorganisation of the army in 1936, few effects were to be seen until 1939. Sir Cyril Deverell, Chief of Imperial General Staff, had planned sweeping mechanisation of cavalry units, and the equipping of infantry and field artillery with motorised transport. It was said by Captain Liddell Hart, the prominent military commentator, that the provision of tanks and trucks was actually less than in previous years. One important introduction was a lightly armoured, tracked carrier to mount the newly adopted Bren gun. These machines played a useful part in the war that was to come, and the Bren gun carrier became a familiar feature among troops.

While this was going on, there was a general move by the major powers towards fuller armour establishments. The post-1918 armies of Soviet Russia had only the tanks of British and French make that they had captured from the White Russians in the Civil War, but by 1925 Russia had begun to build on the lines of the major powers.

When the Soviet designers developed their own machines, they made use of the best features of tanks bought from other countries. By 1936 Russia's tank fleet was estimated at 15,000 first-rate units. Unfortunately, most of the Russian types, T26 light, BT cruiser, T37 amphibious, T28 medium, and T35 heavy, were obsolescent when the German attack came in 1941, and their newer machines were not in full production. The other Allies bridged this gap with supplies of their own tanks until the Russians' production was in full swing.



U.S.S.R.: T34, 1940.
[redacted]

One of their most successful tanks was the T34 medium design of 1940. It was a 28-ton machine carrying a crew of four, and its diesel engine gave a road speed of 34 m.p.h. T34's gun was a 76·2 mm., or an 85 mm., with two 7·62 mm. machine-guns, and its armour ranged from 20 mm. on the bows to 100 mm. on the turret. This was a well-designed, manœuvrable vehicle, like the heavy 46-ton KV1 (Klimenti Voroshilov) of the same year. In KV1 the armour varied between 26 mm. and 100 mm., and a 76·2 mm. was mounted with three 7·62 mm. Both machines had electric and compressed-air starters.

Russian tanks were roughly finished, but they were easily made and stoutly armoured, with a general purpose gun as the main weapon. In general, the protective design was good and the road speed was high, though little attention was paid to the comfort that made for easy and efficient management.

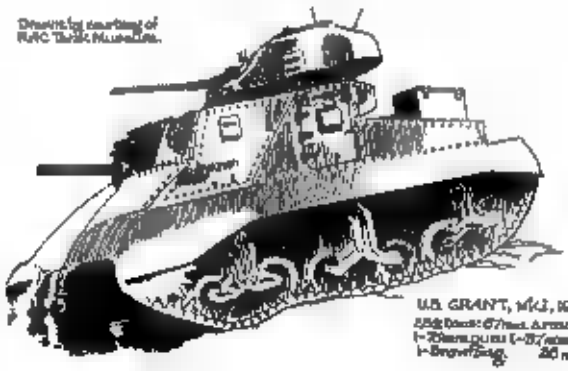
The Americans' deficiency in tank lore was amply made up between the two wars. A major contribution [redacted] the Christie suspension system already noted, in which each wheel was mounted on a pivoted arm bearing a long adjustable coil spring. Most of the U.S. production work consisted of experimental types, on which were based the successful M (standard) class tanks of the 1939 war, such as the M3 (*Grant*) and M4

(*Sherman*). M6 was a super-heavy tank of 65 tons, with a 26-mm.–84-mm. armour range, and a road speed of 23 m.p.h.

Though a great number of M6 machines were ordered, it was found too difficult to carry out transport overseas, as the M6 could not be easily dismantled for travelling. A design known as M26 (*Pershing*) of 38 to 41 tons, went into production instead. It was armed with a 90-mm. high-velocity gun, two ·30 machine-guns, and one of ·5 calibre.

France, the country that stood to lose most in a German attack, displayed incredible short-sightedness. The French Government had pursued the antiquated "static defence in line" decreed by Pétain. Their whole trust was reposed in a string of immensely strong fixed redoubts, the Maginot Line, which stopped short at the Belgian frontier.

At the beginning of the war there were months of apparent inactivity; then, in early May, 1940, a spearhead of German tanks suddenly burst through into France, around the northern end of the futile Maginot Line. The invaders crossed the Meuse by means of a bridge that inept or traitorous defenders had failed to destroy, and in the wake of the thrusting tanks came lorry-borne infantry. As the first attacking column deployed inside the French defence zone, reinforcements came



U.S. GRANT, M/41, 1941.
[illegible]

[173]

crowding in behind, and powerful air cover completed the demonstration of the *blitzkrieg* – lightning war.

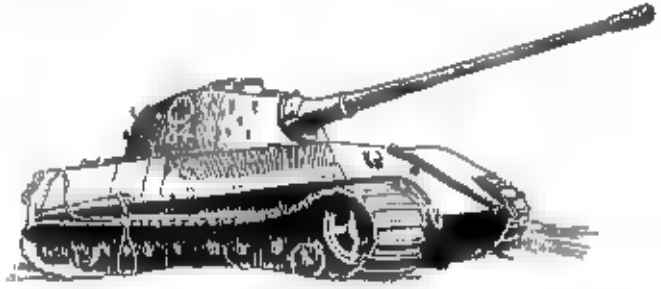
In this smashing assault the Germans made great use of the cruiser tank *PzKw III*. When the British Expeditionary Force left Dunkirk in early June, 1940, about seven hundred British tanks were lost, and there was an urgent demand that the denuded Army should be re-equipped with cruiser tanks to level up with German units. However, this would have meant a crippling switch in production, so a number of infantry tanks were sent to armoured divisions as a stopgap.

Their immense lead in tank-fighting experience and tank production allowed the Germans to improve their effective types while Britain was still trying to rebuild her shattered armour. By early 1941 PzKw III and IV had been reinforced with extra face-hardened plates, which broke up two-pounder shot at any range, and could only be pierced by six-pounder and 75-mm. guns at under 500 yards. A feature of face-hardened plates was the tough backing, which absorbed the energy of the striking missile while supporting the hard face against fracture. Hardening was graded by the Brinell scale, in which armour that could be machined on an ordinary lathe was numbered at under 400, the number increasing in relation to the degree of hardness.

A further step in tank protection was the German use of *spaced armour* – additional plates of 20 mm. thickness, fixed with long bolts in such a way that a 4-in. gap lay between the true frontal [redacted] and the extra plates. The latter were intended to destroy the cap of the APC (armour piercing capped) shot, and lessen the blow against the basic plating. This spaced armour was in use in the summer of 1942, at which time the German lead was still very considerable. PzKw III tanks had spaced plates rating to 800 on the Brinell scale, with deep hardening that no British tank could equal, and which no British gun could pierce.

German tank commanders were so impressed by the Soviet T34, which they saw during the Russian campaign, that after 1941 there was a noticeable leaning towards Russian ideas. When the Germans brought out the 56-ton *Tiger* in 1942, it displayed the sloping frontal armour and overhanging gun of the T34.

Tiger was the most formidable armoured fighting vehicle of that time. Its interlocking frontal plating ranged from 26 mm. ■ 105 mm., and its main arm was the outstanding 88 mm. guns, supported by two 7·92-mm. machine-guns. Each of the



GERMANY: TIGER II (ROYAL TIGER) 1944.
6-in. armour; 67 tons; 1–88 mm. gun, 2 mgs; 23 mph.

eight axles carried interleaving bogie wheels for even weight distribution, the road speed was 25 m.p.h., and *Tiger* could plough through 13 ft. of water. Even more powerful was *Tiger II* (the "Royal Tiger") of 1944. It weighed 67 tons, with armour up to 150 mm. – the heaviest tank to be used during the whole of the war. This machine was armed in the same way as its precursor, and it shared the latter's defect of mechanical weakness.

A rather similar tank was the 45-ton *Panther* of 1942, whose lines resembled the T34 in some measure. *Panther* was armoured to 110 mm. and gunned like the *Tigers*, though it was 3–4 m.p.h. faster than the latter.

Large numbers of these three types were made, while German designers were working their hardest on a super-heavy tank, conceived by Dr Ferdinande Porsche. Exactly as in 1918, the Armistice of May, 1945, found the German High Command with two prototypes of *Maus*, a giant machine of 185 tons, with armour from 50 mm. to 215 mm. thick. Two cannon, a 128 mm. and a 75 mm., were mounted co-axially in the turret, with a 7·92-mm. machine-gun.

Maus was not regarded very favourably by the German army. Huge tanks, like huge battleships, could deal shattering blows, but they were immense targets for counter-action.

Armour at Bay

Britain's great disadvantages at the beginning of the Second World War were the small numbers, relatively thin armour, and low gun-power of her tanks. In action, many of the British tank crews became painfully aware of the Germans' superiority in anti-tank gunnery. Infantry tanks Mark I and II were proof, but there were too few of them at the outset, and the light tanks were soon withdrawn, except for some that were fitted up as A.-A. units.

Though a great deal of work had been done in Britain towards the development of the tank, it could not equal the fierce German concentration in that arm. With ground armour and dive-bombers, the Germans had worked out a skilful attack method with a radio link. When the advancing tanks met a stubborn obstacle, they radioed for the dive-bombers to blast it.

Another German development was the bigger tank gun,

PzKw IV mounting a 75 mm. This was not countered by the Allies until 1942, when *Crusader* Mark III carried a six-pounder with high-velocity AP shot. Even so, the initiative was with the Germans for the greater part of the war. They even contrived a tiny "beetle tank", scarcely three feet high, to carry one man.

Until the British units gained better anti-tank artillery, they made use of a negative defence in the smoke-screen, created by various forms of discharger and the smoke bomb. This system was retained after the war as an emergency measure.

In 1941, when America supplied tanks to make up for the British losses in desert warfare, a significant new feature began to appear in the Allied tank armament. While America was neutral, her observers had noted the German use of the 75-mm. tank gun, and this was adopted in the U.S.A. *Sherman* medium tanks carried the gun as a dual-purpose weapon, for direct and indirect (unseen target) fire, using AP shot, [redacted] shell, or smoke-shell as required. There were a great number of Shermans available, in weights ranging from 30 to 34 tons, with a road speed of 20 m.p.h. and a crew of five. Though not really heavily armoured (133 mm.) this was a popular tank; it [redacted] manœuvrable and easily maintained.

British designers had produced a 27-ton cruiser tank *Cromwell* in 1943, with an operative range of 165 miles – longer than any other British tank. Mark IV was armed with the newly developed British 75-mm. gun, but the latter proved incapable of piercing the big German tanks at anything but close range, when her own 76-mm. armour was not enough defence.

As with all British cruiser tanks, *Cromwell's* armour was increased to 101 mm., and a bigger tank gun was provided, the seventeen-pounder Mark 2, anti-tank pattern. This needed a larger turret mounting than British tanks could then take, so many Shermans were fitted out with the gun. Later, some *Cromwells* were supplied with enlarged turrets and improved

suspension, and this modified vehicle was named the *Challenger*.

One of the most successful British machines was put into operation with only a fraction of the usual amount of testing – almost "straight from the drawing board". The *Churchill*, infantry tank Mark IV, of 1941, weighed 38½ tons, with frontal armour of 102 mm. At first it was armed with the universal two-pounder co-axial with a Besa 7·92 mm., and a 3-in. howitzer in the bows – a unique feature later replaced with a Besa or a flame-thrower. This powerful tank passed through a number of stages, to Mark XI LT, and in the later Marks there was 152-mm. armour, with a 75-mm. gun as the main weapon, though the speed was much reduced (17 m.p.h. to 12½ m.p.h.). *Churchill* was the first tank to be fitted with Merritt-Brown steering, which is still used in present-day machines. In this system the gearbox contains a differential and two epicyclic steering units.

During the [redacted] of the war, efforts were made to provide visibility when the tank was closed down. Though the tank commanders of the First World War had developed the technique of steering by instruments, it [redacted] better, of course, to have an actual lookout. A great danger attending upon open lookouts was that of *bullet splash* – the already heated bullet could break up in contact with armour plate, creating friction that melted the lead core and projected liquid lead through any nearby aperture.

This splashing was one of the drawbacks of the cupola first applied to the turret to accommodate the commander's head, so solid glass *vision blocks*, with deflecting surfaces, were introduced. A better scheme was the Vickers Tank Periscope, though the arc of vision was limited. The device was first used [redacted] the original A9 cruiser tank, and during the war it was arranged for each of the tank's crew to have a periscope, with two for the driver. By 1944, [redacted] *vision cupola* with eight epi-

scopes provided an all-round outlook for the commander, with no need for turning the cupola as before.

As in the First World War, the final stages showed a remarkable variety of armoured vehicles. Some Churchills, renamed *Crocodiles*, were equipped with flame-throwers of 100 yards range, fed from a 400-gallon trailer reservoir, and a number of U.S. Shermans carried sixty tubes each, for 4·5 rockets, which delivered a shattering blow. Minesweeping tanks were employed, one pushing a form of plough called a "bull's horn", at 4 m.p.h., to clear the mines aside, and another of similar type called "the Farmer's Deck Plough". A number of Matildas and Shermans carried flails. One form of amphibious tank with a retractable screw was based on Sherman and Valentine machines, and the Royal Engineers had special armoured demolition vehicles mounting huge petard mortars. Airborne forces employed *Tetrarch* and U.S. *Locust* light tanks transportable in gliders.

Frequently, chassis from outdated machines were fitted out as recovery units, to locate and tow in damaged or broken-down tanks – a worthwhile task in areas like the North African desert, where tank wastage was high. In some cases conversions were made for another purpose – the provision of mobile bridges, on such machines as the Churchill, Covenanter, and Valentine. They carried folding or fixed bridges that would bear weights of 60 tons, and would cross gaps up to thirty feet wide.

Defensive anti-tank measures were developed for use by infantry, in addition to the armour-piercing gun. Two examples of grenades were the time-fuse *sticky bomb*, to be fixed to the tank's plating by its own adhesion, and the Russians' *Molotov cocktail*. This was a thick glass bottle containing phosphorus and liquid rubber, which was thrown against the tank. When the bottle broke, the contents ignited in contact with the air, and the idea was that the rubber would keep the flaming phosphorus against the plating and leading the fiery mixture inside

through crevices. These bottle bombs, devised by Russian guerrillas, sent out flames ten feet high on bursting.

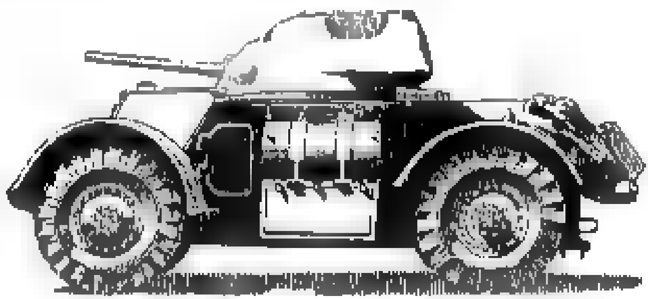
Special tank-destroying squads were formed by the Russian defenders, to exploit the known fact that [redacted] single well-placed grenade could damage the track and cripple the tank. Some intrepid bombers would establish themselves in narrow pits over which the German armour would be advancing. As the machine passed overhead the destroyer threw or stuck on a grenade, and crouched in the bottom of his pit to avoid the blast a few yards away.

British Hurricane fighters over the North African desert were equipped [redacted] "tank-busters", with cannon or rockets. The ceaseless battle between missile and armour [redacted] still being fought on land and sea, and in the air. Two great phases had occurred, with the second just coming to its close – the armoured man and the armoured ship, both declining before the power of missiles.

While the land war was still raging, in the early part of 1945, the steel warship of the land maintained its position despite gun, rocket and bomb. With its six-inch armour, its powerful engines, and its hard-hitting guns, the tank was still [redacted] vital factor in warfare. Quite early in the war the Americans had mounted turret guns with *stabilisers*, which kept the sights on the target despite rolling and pitching over rough ground.

The desert warfare in North Africa had brought into great prominence the armoured car, designed for desert fighting, with a short wheel-base for easy manœuvring. In most cars, the plating was arranged to present a series of angles and lessen the chance of penetration, so that a car with 12-mm. armour might be given protection equal to several millimetres more by this practice. By 1941 all British cavalry units, including the Household Cavalry, were mechanised, and the cavalryman rode into action in the armoured car.

These vehicles were not intended for use as tanks, but [redacted] protected reconnaissance units capable of mounting a brief action at need. On some occasions, they engaged tanks with success; for instance, the 12th Royal Lancers, with their three-man Daimler Mark II cars, knocked out several tanks, including a PzKw IV. This was done with a two-pounder gun fitted with [redacted] Littlejohn Adaptor, and [redacted] special super-high-velocity shot. The Daimler weighed 6¾ tons, with 16-mm. armour, and its speed was 50 m.p.h.



Drawn by courtesy of RAC Tank Museum.

U.S. STAGHOUND ARMOURED CAR, Mk. I, 1943.
32 mm. armour: 12 tons: 50 m.p.h.
1–37mm gun: 2 Brownings: bomb-thrower

An American machine that gave useful service was the M8 (*Greyhound*) of 1943. It was low, quiet, and fast (56 m.p.h.), and it [redacted] armed with a 37-mm. gun and a ·30 Browning mounted co-axially. Though its front and side [redacted] were 22 mm. and 9·5 mm. respectively, the bottom plating was too thin to withstand the blast of a mine, [redacted] in action the floor was lined with sandbags.

Armoured cars were often confined to the roads in broken [redacted] otherwise unsuitable country, and they were thus in danger from aircraft. Progressive schemes for A.-A. machine-gun mountings were brought forward. In the 19-ton *Staghound* of 1943 (anti-aircraft model), twin ·5 Brownings were equipped with a Naval-type illuminated sight.

Another form of light protected vehicle was the scout car, used in action by liaison officers. This type of machine weighed from three to four tons, it was armoured to about 30 mm., and its speed ranged from 60 to 75 m.p.h. An advanced model was seen in the Humber Mark III light recce car of 1942, mounting a Bren with a 100-round magazine in a roof turret, and a Boys anti-tank rifle in the crew compartment.

Germany surrendered in May, 1945, as her abandoned, fuelless armour strewed the French countryside, but the tenacious Japanese, careless of life, fought on. At last, the long war was ended when in August of the same year the U.S. Army Air Force delivered the two most stunning blows ever dealt in war. Those atom bombs, of relatively small force compared with later nuclear weapons, pointed to the finale of the armour epoch. In the face of an attack like that, armour would have been completely futile, and that single feature concluded the whole story. Even if no other nuclear weapon ever came into action, the fact of its existence meant that no armour could ever be thought proof against any attack. The long struggle had been finally won by a missile against which there was no defence.

True to pattern, the promoters of the armoured vehicle fell back upon a natural defence – darkness. In the autumn of 1960, an American "night eye" for tanks was made public. It was an infra-red searchlight, whose invisible rays were reflected from objects within range, to be picked up through infra-red binoculars.

A further development, announced in October, 1960, was an electronic night-vision tube, said to permit sighting from 500–1,000 yds., twenty times further than before.

[redacted] and Armour

When the British Army entered the Second World War the steel helmet of 1915 pattern was on issue, with improved shock absorbers. During 1940, the turn of events caused a partial change. German parachutists invading Holland wore a small, almost brimless pattern of helmet, to avoid tangling in the parachute lines and to make easier the removal of the jerkin covering the belted equipment.

Within a few months, Britain had trained and equipped paratroops, similarly helmeted but stupidly armed with rifles instead of machine carbines such as the Germans had. When America was brought into the war in 1941, her troops all wore completely close, brimless helmets, which, though convenient, only protected the head.

Metal body-armour has no place in modern warfare, but for some years U.S. scientists were leading in experiments with other protective ideas. The American product called *Doron* was made up of layers of glass cloth, impregnated with synthetic resin. About twenty curved Doron plates, 5¼ in. square and ⅛ in. thick, were sewn into pockets in a nylon vest. This formed a defence that was 90 per cent successful in preventing serious wounds. Doron was intended to give protection from fragments of grenades and mortar bombs by separating into layers as the missile struck, thus cushioning its penetrative power.

An early form of Doron vest, with flat plates, was issued to U.S. Marines during the war in the Pacific (1941–45). The pattern that they used in the Korean War (1950–53) weighed 7 lb. and cost $45 per vest. Hedge-hopping pilots wore these

vests as well, and the U.S. Army ordered 25,000 Marine pattern vests in 1952, though their own type of vest, weighing 8 lb., at $110 each, had been put on order.

For police or civilian use, ■ bullet-proof vest was being made by Bernard Spooner, of New York, in 1955. This vest protected the wearer from ·303 bullets at 200 ft., though it was normally tested with ·357 pistol bullets. The pocketed nylon vest carried plates of ·04 in. steel, up to 4 in. by 7 in. in size, in weights up to 5 oz., according to the weight of the vests. These ranged from 8 lb. to 12½ lb.

Some devices of past ages occasionally recur in modern times. The Doron material reminds one of the flax-and-glue layered armour of the ancient Egyptian; the mediaeval-pattern "tin hat", and the reintroduced socket bayonet show other revivals. However, the long-suffering Home Guard of Great Britain in 1942 felt that rather too much mediaeval bias was shown when they were issued with a primitive pike – a 16-in. bayonet brazed to a length of water-pipe. One well-known statesman of the time, in boosting the pike, said that it would be a silent and effective weapon with which to follow up a grenade. Most Home Guards must have perceived that silence would hardly be important after the explosion.

It is refreshing for us, after contemplating modern means of destruction and protection, to glance towards those remote corners of the world where progress has not stamped on with ruthless feet. There the primitive usages of thousands of years are still maintained, and if quarrels and wars break out, they ■■ but storms in ■ teacup by comparison.

Among the islanders far south in the Pacific body-armour is still made up of wicker-work, coco-fibre, or bone. Their weapons can inflict wounds and death, but they use the arms of their distant forefathers – they are not concerned with great advances in the name of Armour and Blade.

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